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A REVISION OF THE SOUTH AUSTRALIAN JERBOA MICE, WITH THE DESCRIPTION OF A NEW SPECIES

BY FREDERIC WOOD JONES, D.SC.

Summary

The beautiful jumping mice which inhabit the vast open spaces of Australia are such peculiarly Australian types that it is rather remarkable that they have received so little attention from Australian zoologists.

Of the ten species and sub-species so far recognized, one was described by W. Ogilby (1838), three by Gould (1844, 1851, and 1863), and six by Thomas (1921, 1922).

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The distinction of these jumping mice is in their adaptive modifications to a saltatory mode of progression; they have become adapted along lines similar to those which have moulded their marsupial companion *Antechinomys*, and similar to those that have resulted in the development of the true Jerboas *(Dipodinae)* of the Palaearctic and Ethiopian regions.

The Australian jumping mice were for long included with other specialized rodents, which, however, showed no saltatory modifications, in Lichtenstein's genus *Hapalotis* (1829). This name, being preoccupied, was superseded by *Conilurus* W. Ogilby (1838).

It is a curious fact that, though saltatory and normal forms were contained in this large genus, the non-saltatory animals were all named Jerboa Rats or Jerboa Mice. The type of the genus was *C. albipes*, an animal showing normal proportions of the limbs, and it is remarkable that, although this and many other non-saltatory rats were contained in the genus, an elongation of the hind limb was defined as one of the generic characters. It was not until 1898 that Waite rescued the true saltatory Jerboa mice from the mixed assemblage of normally proportioned murines contained in the genus *Conilurus*. Although incorrect generalizations had been previously made concerning the elongated hind limb, Waite was the first to recognize that, in the high specialization of the elongated foot, the true Jerboa mice showed themselves to be a distinct and well-defined group.

To this group with the modified feet he gave the name of *Podanomalus* (1898), the type of which was *P. longicaudatus*, but, since Lesson had already (1841) given the name *Notomys* to the first recognized Australian Jerboa mouse *(N. mitchelli)*, this name has priority over Waite's appropriate designation. In the same paper of 1898, Waite drew attention to the gular pouch possessed by

the Fawn-coloured Jerboa mouse, and he proposed for this species a new generic title, *Thalacomys*, but finding that this name might be in jeopardy, owing to preoccupation, he replaced it in 1900 by *Ascopharynx*, with *A. cervinus* as the type of the genus.

In 1906 Oldfield Thomas wrote: "I am not at present prepared to consider its possession of a gular pouch as a character of generic importance, and should therefore place *Ascopharynx* as a synonym of *Notomys*."

Until the present time *cervinus* has remained alone as a Jerboa mouse in which a gular pouch has been described; and it is much to be regretted that in no recent description of a new species is any attention given to this point. The discovery of another well-defined species possessing a gular pouch, combined with the utter lack of any suggestion of a pouch in the remaining Jerboa mice of which I have made a thorough examination, considerably strengthens Waite's opinion of the generic distinction of the pouched forms. I have, therefore, followed Waite in separating *cervinus* and its new ally from those Jerboa mice in which we know, from repeated examinations of recent specimens, that no pouch exists. The detection of a new pouched form with a specialization of foot structure made it imperative to ascertain if, what may be termed the original Jerboa mouse *(mitchelli)* was pouched or pouchless. At my request Mr. E. Le G. Troughton very kindly examined the two type specimens of *mitchelli* in the Australian Museum, Sydney, and although the condition of the specimens is not ideal, he reported concerning the pouch: "I feel reasonably sure that the character is not present in the two *mitchelli*."

As Waite suggested in 1898, *mitchelli*, therefore, allies itself with *longicaudatus*.

We may then feel some assurance in the nomenclature of the two pouchless forms with which we are familiar, of which abundant and satisfactory material has been examined, and of which adequate descriptions have been published.

All measurements in millimetres.

NOTOMYS LONGICAUDATUS Gould, 1844.

This well-defined species has been adequately redescribed by Waite (1898). No specimens examined by present writer. Its essential characters are as follows:

Colour. Sandy above, with some dark hairs admixed; white below.

Gular pouch. Absent

Pes. Length, *circ.* 43 mm. Hallucal pad present.

Tail. To 190 mm.

Skull. Basal length 33 mm.

Upper molar series. 6·5 mm.

NOTOMYS MITCHELLI Ogilby, 1838.

Numerous specimens, including one from type locality, examined by present writer.

Colour. Grizzled isabelline brown above, white below, hairs dark smoky at base.

Gular pouch. Absent.

Pes. Length, *circ.* 36 mm. In sub-species *macropus* 39 mm. Hallucal pad present.

Tail. To 155 mm.

Skull. Basal length, 27-30 mm.

Upper molar series. 5 mm.

Of the pouched forms there are also two well-defined species present in the fauna of this State.

ASCOPHARYNX CERVINUS Gould, 1851.

This distinct species redescribed by Waite (1898). Numerous specimens examined by present writer.

Colour. Pale sandy, with occasional dark tipped hairs on dorsal surface. Ventral surface white, hairs white to their roots.

Gular pouch. Present in both sexes.

Pes. Length, 34 mm. Hallucal pad present.

Tail. To 155 mm.

Skull. Basal length, 26-28 mm.

Upper molar series. 5 mm.

ASCOPHARYNX FUSCUS sp. nov.

Characters may be epitomized as follows:

Colour. Rather drab and uniform isabelline light brown above. Below white; the hairs pale smoky at the bases.

Gular pouch. Present in both sexes.

Pes. Length, *circ.* 33 mm. Hallucal pad absent.

Tail. To 135 mm.

Skull. Basal length, 27 mm.

Upper molar series. 5 mm.

Extended description.

This little jumping mouse, which is readily distinguished from its allies by its external characters, has previously been confused with the other Jerboa mice

in whose company it happens to be living in any of the districts of the more arid parts of the Centre.

In describing *A. cervinus*, Gould mentions that a darker form is sometimes met with, and he figures, in a rather unconvincing manner, this darker form in the background of his plate depicting the Fawn-coloured Jerboa Mouse. Waite, when examining the specimens of Jerboa mice procured by the Horn Expedition, noticed that among the specimens obtained from Charlotte Waters and Alice Springs there were some specimens which, though possessing a gular pouch, differed from *A. cervinus* in being of a darker colour.

Of this type he wrote: "A darker form was considered to be a second species of the genus *(Ascopharynx)* until a comparative examination of the skulls showed it to be specifically identical. The fawn-coloured portions are replaced by a much deeper tint, and the fur of the underparts is grey at the base." He also stated that "In colour it resembles *N. mitchelli*."

In noting the difference in the colour of the base of the ventral white hairs, Waite recognized one of the specific characters of *A. fuscus*.

In separating the members of the old genus *Conilurus* into those with normal feet and those with specialized feet, Waite noted that of the six pads present in normal murines "two or more are absent" in the Jerboa mice. As we have seen, two are absent in all the forms previously described: the only member, which has been adequately described up to the present time, having more than two absent is *A. fuscus*.

The fact that the so-called "dark form" of *A. cervinus* has a different type of sole pads, as well as a different character of coat colouration, gives it the right to specific rank; and the animal is here named *Ascopharynx fuscus*. It may be said at once that, in all, some ten species of Jerboa mice of the genera *Notomys* and *Ascopharynx* have been described, but the descriptions of most of these species are so insufficient that it is impossible to determine if the present form has been previously named by authors who have neglected details of structure necessary for the proper determination of the species of this genus.

This species, which resembles *A. cervinus* in possessing a gular pouch in both sexes, differs from that species in general colouration and in the colour of the individual hairs, as well as in the fact that the foot, which is considerably broader, has no pad at the base of the first digit.

The general colour of the head and dorsal surface of the body is light isabelline brown, lacking altogether that yellowness which renders *A. cervinus* fawn-coloured. Not only is the shade of yellow absent, but the whole colouration is considerably darker and more drab. In general form it resembles *A. cervinus* very closely, and its measurements do not differ in any constant direction from those of that species.

The individual hairs of the dorsal surface are smoky at the base, brown in the greater portion of their length, the tips being only slightly darker than the

shafts. The contrast between the colour of the shaft and the tip of the hairs of the dorsal surface is not so marked as in *A. cervinus*, the whole pelage being more uniform dull brown and not so definitely flecked with dark tipped hairs at the hinder end of the body. At the sides of the body the darker tips of the hairs disappear altogether, and the brown of the dorsal surface merges somewhat gradually into the white of the ventral surface. The face is uniformly coloured the same light brown as characterizes the head and dorsal surface. The outer side of the limbs rather brighter brown than the dorsal surface. Inner side of the limbs and the whole of the ventral surface white, but, in distinction from *A. cervinus*, the white hairs of the ventral surface are pale smoky at their bases and not pure white in the whole of their extent, as they are in that species.

The rhinarium is dusky pink, and is not so prominent or hooked as it is in *A. cervinus*. The vibrissae are long and, save for a few of the short anterior members, which are white throughout, are dark brown at the base and white at the tips; the longest measures 52 mm.

The ears are long, thin, and membranous, but are dusky in colour throughout, a few light brown hairs clothing the base without, and being sparsely scattered over the surface of the auricle. Manus and pes white, but the soles more dusky in colour than those of *A. cervinus*.

The pes is more robust than that of *A. cervinus*, its breadth across the base of the three middle digits averaging 6 mm., instead of 4.5 mm. in the latter species. The pads of the soles are constantly reduced to three, the pad at the base of digit 1 being quite unrepresented.

The tail is long, considerably exceeding the length of head and body. It is clothed with short brown hairs on its dorsal surface and well pencilled at the end with a tuft of brown hairs; below, the hairs are white, a small portion of the ventral surface of the terminal pencil being composed of white hairs. The scale rows average fourteen to the centimetre.

The gular pouch is present in both sexes, and differs in no way from that of *A. cervinus*.

The nipples are four in number and abdomino-inguinal in position.

Dimensions.

SPECIMENS FROM OOLDEA.

	♂	♂	♀	♀
Head and body	110	103	110	105
Rhinarium to ear.. ..	31	28	29	28
Ear	27	25	—	25
Pes	34	32·5	33	32·5
Tail	125	85*	135	108*

*The tails of these specimens imperfect.

The skull differs from that of *A. cervinus* in possessing palatal foramina which do not extend backwards past the anterior edge of the first molar tooth, and in the form of the mesial pterygoid processes, which are curved outwards at their posterior extremities, instead of being practically straight.

Dimensions of Skull.

ADULT ♂ FROM OOLDEA.

Greatest length	30
Basal length	27
Zygomatic breadth	16
Interorbital constriction	5·5
Nasals length	10
Palate length	15
Upper molar series	5

This Jerboa mouse is not uncommon about Ooldea, whence I have received numerous specimens from Mr. A. G. Bolam. Although at Charlotte Waters and Alice Springs it was found living in company with *A. cervinus*, with which species it has, as we have seen, been previously confused; at Ooldea it lives in company with *Notomys mitchelli*, and there is confounded with that species.

Although in giving brief summaries of the characters of the previously described species of Jerboa mice, measurements of foot and tail and skull have been employed, it must be remembered that the diagnosis is not made solely on the measurements. There has been a tendency to over-estimate the importance of mere size in determining the specific characters of members of these genera. So much is this the case that no proper comparison may be made between my species *A. fuscus* and the published descriptions of some of the other recently described species. All Australian zoologists will realize that no system of measurement alone can ever determine the specific identity of mammals inhabiting the arid Centre. Their adult size depends upon the nature of the seasons in which their span of life is passed. As Sir Baldwin Spencer noted, in the Zoology of the Horn Expedition, animals living during a succession of good seasons are larger than those which have grown during a successive series of bad seasons. One of the most remarkable instances of this is that of *Dasycercus cristicauda*, which, in the second generation bred in captivity, exceeds its wild ancestors very remarkably in size. The same factor must be considered when dealing with the Jerboa mice, as the following measurements of a series of *N. mitchelli* will show:

	Average of five wild-caught specimens from Ooldea.	Maximum measurements of wild-caught specimens.	Female specimen bred in captivity from wild-caught parents from Ooldea.
Head and body	121	125	132
Rhinarium to ear	31·4	32	32
Ear	25	26	26
Pes	35·8	37·5	39
Tail	147	155	150

This increase of size applies to the skull, as well as to the external measurements.

	Wild-caught specimen.	Specimen reared in capitivity.
Greatest length	31	34·5
Basal length	27	30
Zygomatic breadth	16	17·5
Interorbital constriction	5	6
Nasals length	10·5	13
Palate length	15·5	17
Upper molar series	5	5

It will be noticed that in this general enlargement of the skull the teeth take no part. The same fact holds good with other murines, since the skulls of *Rattus murrayi* kept in confinement show a considerable increase in size, but the very small teeth, diagnostic of the species, remain unaltered. It is to be hoped that Australian workers will make a closer study of the Jerboa mice before it is too late, and that good general descriptions, instead of a few measurements, may be forthcoming of all species at present existing.

REFERENCES.

Waite. (1) Proc. Roy. Soc. Vict., 1898 (new series), x, pt. ii, p. 117, pl. v, vi, (2) Ann. Mag. Nat. Hist., ser. 7, ii, 1898, p. 196. (3) Ann. Mag. Nat. Hist., ser 7, v, 1900, p. 222.

Oldfield Thomas. (1) Ann. Mag. Nat. Hist., ser. 7, xvii, 1906, p. 82. (2) Ann. Mag. Nat. Hist., ser. 9, viii, 1921, p. 536. (3) Ann. Mag. Nat. Hist., ser. 9, ix, 1922, p. 315.

THE EARED SEALS OF SOUTH AUSTRALIA

BY FREDERIC WOOD JONES, D.SC.

Summary

The Otarid seals that inhabit the Australian coasts have been subject to much confusion in literature. There are several reasons for this, among wihich the following are the most important: the rather vague descriptions given by the early navigators; the hasty diagnosis of specific and generic characters on insufficient material, notably by Gray; the local use and frequent misuse of the terms Fur Seal and Hair Seal, Sea Lion and Sea Bear; the great changes which age, sex, and wetness or dryness effect in the appearance of a seal. The present paper applies particularly to the seals of South Australia, where the author has alone made first-hand observations.

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Sealing as an organized industry has ceased to exist in South Australia; but there are many men still living who took part in all the old activities and brutalities of the sealing days. For these men there were two kinds of seal normally resident on the coast and islands: (i) A "Fur" seal, a small animal with an under-fur, and valuable for its pelt; (ii) A "Hair" seal, a larger animal with no under-fur when adult, and valuable only for its hide and oil.

We may say that a fur seal is an animal which when adult averages six feet for a wig (♂) and five feet for a klapmatch (♀).

The hair seal, on the other hand, is far larger; an adult bull going to ten, or even more, feet, and an adult klapmatch to an average of about eight.

What are the proper specific names for these two animals?

Péron gives the first description of the South Australian seals, and, to my mind, his account (despite the fact that his promised monograph never saw the light of day) is clear enough, even in the running account of the voyage.

His first specific naming occurs in the description of animals seen on Kangaroo Island during the stay from December, 1802, to February, 1803. The original account is as follows: "Parmi les Phocaces nombreux qui peuploient les rivages de l'ile, on distinguoit surtout un nouvelle espece du genre Otarie (*Otaria cinerea*, N.) qui parvient a la longueur de 30 a 32 decimetres (9 a 10 pieds). Le poil de cet animal est tres court, tres duret, tres grossier: mais son cuir est epais et fort, et l'huile qu'on prepare avec sa graisse est aussi bonne qu'abondante.

"Pour l'un et l'autre rapport, la peche de cet amphibie offriroit de precieux avantages: il en es de meme de quelques autres especes de Phocaces plus petites

qu'on trouve egalement en tres-grand nombre sur ces bords, et qui portent des fourrures de bonne qualites."

To Allen (1) such a description might justify Péron's *Otaria cinerea* being placed among "mythical and undeterminable species"; but only the lack of local knowledge could warrant this attitude. It is obvious that: (1) Péron's *Otaria cinerea* was a large seal nine to ten feet long; (2) that it was a hair seal; (3) that its only value lay in its leather and oil; (4) that it was different from the smaller fur seals which existed in great numbers, and which were not specifically named.

The next phase in the history of this specific name is its re-use by Quoy and Gaimard. These authors, during the voyage of the "Astrolabe," examined a seal from Western Port, and identified it with *Otaria cinerea* Péron. "Comme cette espece" *(O. cinerea)*, "le meme selon nous que celle qui nous occupe, a ete admis dans les catalogues." They then describe an adult male seal seven feet long, and on parting the hair of which "on voit un feuture roux peu epais."

That Quoy and Gaimard's Otarie Cendree was an animal altogether different from Péron's *Otaria cinerea* is obvious. It is therefore difficult to see how Quoy and Gaimard's specimen, which is preserved in the Zoological Gallery of the Museum at the Jardin des Plantes, can rightly be referred to as the type of *Otaria cinerea* Péron, although Clark (10) has suggested this course.

To those familiar with the Eared Seals of South Australia it is at once apparent that Péron applied the name *Otaria cinerea* to the large hair seal of Kangaroo Island (there can, I submit, be no alternative to this suggestion), whilst Quoy and Gaimard, in error, applied Péron's name to the smaller fur seal—the animal which Péron had mentioned but had not named.

In order to unravel the nomenclature and synonomy of these animals it is best to adhere to the terminology of the old sealers, and deal first with the Hair seal and then with the Fur seal.

The Large Hair Seal, also locally termed the Cowled Seal or Counsellor Seal, in books often termed Australian Sea Lion.

By sealers the male is known as the bull and the female as the klapmatch.

(*a*) Péron (1) undoubtedly referred to this animal when he bestowed the name *Otaria cinerea* on the large hair seal of Kangaroo Island (Isle Decres). Since no mention is made of the light mane or cowl in Péron's description, it seems certain that his diagnosis was made from klapmatches and young bulls only.

(*b*) Péron (2) also certainly gave the name *Otaria albicallis* to the same species when he saw the older bulls on St. Peter Island (Isle Eugene). His

(1) Allen, History of North American Pinnipeds, 1880, p. 215.

description is as follows: "Tous ces individus appartenoient a l'une espece nouvelle du genre particulier que j'ai cru devoir etablir sous le nom d'Otarie. Ils parviennent a la longeur de 8 a 9 pieds, et se distinguent sur-tout par une grand tache blanche a la partie moyenne et superieure du cou; c'est d'apres se caractere, que j'ai decrit ce phocace nouveau sous le nom d'Otarie Albicolle" (*Otaria albicollis* N.).

Péron contrasted their behaviour with that of other seals, and said they were "d'un natural bien moins timide que ces derniers"; another indication that he was dealing with bulls of a species of which he had previously seen only klapmatches.

(*c*) Gray (3) renamed the same animal as *Arctocephalus lobatus*.

(*d*) Quoy and Gaimard (4) redescribed a small female specimen from King George's Sound under the name *Otaria australis*, they having previously bestowed Péron's name *cinerea* on the Fur seal of Western Port in error.

(*e*) Peters (12) gave it as his opinion that *Otaria cinerea*, *O. lobatus*, and *O. albicollis* were synonyms; but he does not mention the *data* on which he arrived at this opinion.

With various generic designations, it was known under the specific name of *lobatus* or *lobata*, until in 1875 Clark (10) revived Péron's name *Otaria albicollis*.

In Australian zoological literature, however, the specific name *lobatus* persisted until Alexander (15) described it under the name *Eumetopias albicollis*.

Since it cannot be maintained that Péron's description of the Kangaroo Island hair seal is so vague as to leave in doubt the actual animal to which he applied the specific name *cinerea*, this name should be accepted as the designation of the species.

The Small Fur Seal, sometimes known as the Sea Bear.

By sealers the male is known as the wig and the female as the klapmatch.

(*a*) Péron (1) termed this species "Phocaces plus petites qui portent des fourrures de bonne qualite." He did not, however, bestow a specific name on it in the "Voyage," even if he may have done so in the lost monograph.

(*b*) Quoy and Gaimard (4) referred it to *Otaria cinerea* Péron in error.

(*c*) Gray (31) confused it with a perfectly distinct species, *Otaria forsteri* Lesson, 1828).

(*d*) No other name has ever been applied to it, for Allen, Clark, and all later writers have either accepted the erroneous designation of *cinerea* Péron or confused it with *forsteri*. It is obvious, therefore, that the small fur seal of the coasts of South Australia is zoologically an unnamed species, and this being so, I propose for it the specific name of *doriferus*.

With regard to the generic designation of these species. Péron's generic title *Otaria* is generally agreed to have been created for *Otaria jubata*. Accepting *Otaria jubata* as the type of the monotypic genus *Otaria*, I see no reason to dissent from Beddard's conclusion [2] that all the rest of the Eared Seals should be embraced in F. Cuvier's genus *Arctocephalus* (1824), of which the type is *Phoca ursina*. There are certainly no differential features of generic rank to separate *cinereus* and *doriferus*.

The synonomy is as follows (the works are referred to by numbers in the text):

Arctocephalus cinereus.

(1) 1816. *Otaria cinerea* Péron, Voyage aux Terres Australes, ii, p. 77.
(2) 1816. *Otaria albicollis* Péron, *op. cit. sup.*, p. 118.
(3) 1828. *Arctocephalus lobatus* Gray, Spicilegia Zoologica, part i, p. 1, pl. iv, fig. 2.
(4) 1830. *Otaria australis* Quoy and Gaimard, Zoologie du voyage de l'Astrolabe, i, p. 95.
(5) 1863. *Arctocephalus lobatus* Gould, Mammals of Australia, iii, p. 49.
(6) 1866. *Neophoca lobatus* Gray, Ann. and Mag. Nat. Hist., xviii, p. 231.
(7) 1866. *Otaria lobata* Peters, Monatsb. Akad. Wiss. Berlin, pp. 276, 668.
(8) 1870. *Zalophus lobatus* Allen, Bulletin, Mus. Harvard, ii, p. 44.
(9) 1873. *Zalophus lobatus* Scott, Mammalia, Recent and Extinct, p. 21.
(10) 1875. *Otaria albicollis* Clark, P.Z.S., pp. 650-677.
(11) 1876. *Arctocephalus lobatus* Waterhouse, in Hareus's South Australia, p. 283.
(12) 1877. *Otaria cinerea* Peters, Monatsb. Akad. Wiss. Berlin, pp. 505-7.
(13) 1887. *Eumetopias cinereus* Turner, Voyage of H.M.S. Challenger, xxvi, Report on Seals, p. 79 (in part).
(14) 1892. *Zalophus lobatus* Ogilby J. D., Cat. Aust. Mamm., p. 126.
(15) 1920. *Eumetopias albicollis* Alexander, Journ. Linn. Soc., (Zool.), xxxiv, p. 478.
(16) 1922. *Arctocephalus forsteri* Wood Jones, Trans. Roy. Soc., South Australia, xlvi, p. 193.

Arctocephalus doriferus sp. nov.

(17) 1816. Small Fur Seal of Kangaroo Island, Péron, *op. cit.*, p. 118.
(18) 1830. *Otaria cinerea*, Quoy & Gaimard, Voyage de l'Astrolabe, (Zoology), i, p. 89.

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(2) Beddard, Trans. Zool. Soc., xii, 1890, p. 369.

(19) 1859. *Arctocephalus cinereus* Gray, P.Z.S., p. 358.

(20) 1873. *Otaria cinerea*, Clark, P.Z.S., pp. 750-760.

(21) 1884. *Otaria cinerea* Clark, *loc. cit.*, pp. 188-196.

(22) 1874. *Euotaria cinerea* Gray, Hand List of Seals, etc., in Brit. Mus., p. 34.

(23) 1879. *Euotaria cinerea* McCoy, Prod. Zool. Vict., Dec., iv., pl. 31, p. 7.

(24) 1882. *Euotaria cinerea* McCoy, Prod. Zool. Vict., Dec., viii, pl. 71, p. 7.

(25) 1887. *Eumetopias cinereus* Turner, *loc. cit.*

(26) 1892. *Arctocephalus forsteri* Ogilby, *loc. cit.*, p. 127.

(27) 1909. *Arctocephalus forsteri* Lucas & Le Souëf, Animals of Australia, p. 16 (with McCoy's description and figures of *Euotaria cinerea.*)

In order to clear some further uncertainties from this question, it is well to include the synonomy of the typical fur seal of New Zealand.

Arctocephalus forsteri.

(28) 1828. *Otaria forsteri* Lesson, Dict. Class. d'Hist. Nat., xiii, p. 421.

(29) 1829. *Phoca forsteri* Fischer, Synop. Mamm., p. 232.

(30) 1844. *Phoca ursina* Forster, Descript. Animal., p. 64.

(31) 1866. *Arctocephalus cinereus* Gray, Ann. Mag. Nat. Hist., xviii, p. 236.

(32) 1866. *Arctocephalus forsteri* Gill, Proc. Essex. Instit., v, pp. 1-13.

(33) 1872. *Arctocephalus cinereus* Hector, Trans. New Zealand Institute iv, p. 196.

(34) 1872. *Gypsophoca tropicalis* Gray, P.Z.S., p. 659.

(35) 1875. *Otaria forsteri* Clark, *loc. cit. sup.*

(36) 1909. *Arctocephalus forsteri* Waite, Subantarctic Islands of New Zealand, ii, p. 548.

The distinguishing characters of these three species are as follows:

ARCTOCEPHALUS CINEREUS Péron.

Adult male, 10 to 12 feet. Adult female, 8 to 10 feet.

Adult with coarse hair only; dark red under-fur present in pups, but shed later.

Colour. Adult Male. The entire body brown, with the exception of the large yellowish mane which extends from the crown of the head to the shoulders.

Adult Female. Brown on the dorsal surface; ventral surface pale yellowish white. Pups of both sexes brown throughout.

Nails of the three middle digits of the pes extending to the free edge of the interdigital webbing.

Prolongations of middle three digits falling far short of those of lateral digits.

Cranial characters. Adult Male. The saggital and nuchal crests are extremely well developed, and the skull is large and massive. Condylo-basal length to 300 mm.

Adult Female. Crests not nearly so well developed. Condylo-basal length to 250 mm.

Both Sexes. Interorbital constriction, behind supra orbital processes, relatively short, broad, and rounded. Zygomatic arch without marked post orbital processes. Posterior ends of nasals falling considerably short of posterior extremity of superior maxilla.

Dental characters. Cheek teeth variably $\frac{5-5}{5-5}$ or $\frac{6-6}{5-5}$ the smaller formula being most frequently met with.

With numerous small variable bosses of the cingulum, but with no regular secondary cusps.

ARCTOCEPHALUS DORIFERUS sp. nov.

Adult male, about 6 feet. Adult female, about 5 feet.

Adults with coarse hair, but a rich chestnut under-fur retained throughout life.

Colour. Adult Male. Greyish brown on the dorsal surface. Dark brown on the ventral surface.

Adult Female. Ashy-grey or yellowish brown on dorsal surface. Dark brown on ventral surface.

Pups of both sexes. Dark brown.

Nails of three middle digits of the pes fail to extend to the free edge of the interdigital webbing by considerably more than their own length.

Prolongations of middle three pedal digits practically equal to those of lateral digits.

Cranial characters. Adult Male. Crests but poorly marked, and difference between the sexes not nearly so pronounced as in *A. cinereus.*

Condylo-basal length, adult male, to about 250 mm.

Condylo-basal length, adult female, to about 200 mm.

Both Sexes. Interorbital contriction, behind supraorbital processes, long and narrow.

Zygomatic arch with well-developed post-orbital process. Posterior ends of nasals nearly reaching posterior margins of superior maxillae.

Dental characters. Cheek teeth variably $\frac{5-5}{5-5}$ or $\frac{6-6}{5-5}$ the larger formula being usually met with. With well-defined anterior and posterior secondary cusps on all except the last upper molar.

ARCTOCEPHALUS FORSTERI Lesson.

Adult male, 6 to 7 feet. Adult female, 5 to 6½ feet.

Adults with coarse hair, but a light red-brown under-fur retained throughout life.

Colour. Both sexes. Dorsal surface dark brown, grizzled by the presence of white tips to the dark hairs. Ventral surface reddish brown.

Nails of the three middle pedal digits fail to reach the free edge of the interdigital webbing by their own length.

Prolongations of middle three pedal digits not quite so long as those of lateral digits.

Cranial characters. In most gross details falls within the range of variation of *A. doriferus.*

Condylo-basal length of males and females to about 230 mm.

Dental characters. Cheek teeth normally $\frac{6-6}{5-5}$ with only an anterior secondary cusp rising from the cingulum.

Distribution of these three species.

Arctocephalus cinereus ranges from Houtman's Abrolhos in the west to the islands of Bass Straits in the east. In these islands its present existence is, according to Lord, doubtful. At one time its range extended to the mainland of Tasmania, for its bones are frequent in the kitchen middens of the aborigines. The headquarters of the species is now the islands in the Great Australian Bight.

Arctocephalus doriferus apparently ranged from the Recherche group in the west to the eastern coasts of Australia and to Tasmania. At present it appears to be confined to certain islands off Tasmania (Isle due Phoques, the Hippolytes, etc.), to the islands of Bass Straits, and to Casuarina Islands, off Kangaroo Island.

It is years since one was seen by a reliable observer on Kangaroo Island, itself, and, though it is often reported as living on the islands of the Bight, the writer has seen no living animal nor recent specimen. Moreover, no skeletal remains have been found on any of the numerous islands of the Bight visited during the past five years, though a seaworn and broken skull was found on the beach of D'Estree Bay, Kangaroo Island, in March, 1925. The animal still lives on the Casuarina Islands (a proclaimed sanctuary), whence the last cargo of pelts was taken in 1912.

Arctocephalus forsteri frequented the coasts of New Zealand and its sub-antarctic islands, and has many times been reported as a member of the Australian fauna, probably being confused with *A. doriferus*. Of its recent status in New Zealand we have the pleasing assurance of Waite (36) that its numbers have increased, "and if poaching, which undoubtedly takes place, can be stopped, there is no reason why the animal should not again people its old haunts."

[The peculiar word "Klapmatch," applied to female seals, is evidently derived from "Klapmyd," the Danish name of the Hooded or Bladder-nosed Seal *(Cystophora cristata)*. The word "Wig" is the technical name for the coarse hair on the shoulders of a full-grown male fur-seal, hence for the seal itself.—Editor.]

FIELD NOTES ON SOME AUSTRALIAN REPTILES AND A BATRACHIAN

BY EDGAR R. WAITE, F.L.S., C.M.Z.S., DIRECTOR, SA MUSEUM

Summary

The following are extracts from notes on observations made from time to time, mainly in the field, either by myself or by others, to whom the notes are acknowledged. For assistance in connection with the photographs and drawings I am indebted to Messrs. H. M. Hale and B. C. Cotton, of the Museum staff.

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By EDGAR R. WAITE, F.L.S., C.M.Z.S., Director South Australian Museum.

Figs. 1-15.

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CHELONIA.

WATER TORTOISES, Chelodina and Emydura.

Figs. 1-3.

Karloan, a Point Macleay native, was born at a period when his people had to hunt and fish for themselves; in the days when Government rations were unthought of. He says that his tribal name is Mullentypery, the Long-necked Tortoise (*Chelodina longicollis* Shaw), bestowed in allusion to his feats in the water and his faculty for catching "turtles" when a little boy. "Mullen" is the native name of the weed among which the reptile lives. The tortoise is sought by wading, perhaps waist deep, and located by sight or groping with the hands; it does not climb on to logs, and sometimes feeds on land as well as in the water. It can tuck its head and neck completely under the margin of the shell, and lays about twenty eggs in a hole scooped in the ground; the hole is made by the reptile turning itself round and round and throwing out the sand or earth with its feet. The eggs are laid after the first rains in November or December, and the young appear in February or March. It is good to eat.

The eggs laid by one female measure 31 x 20 mm., and five examples are shown in fig. 1 (natural size).

Respecting the Murray River Tortoise (*Emydura macquarii* Gray), Karloan says his name for this species is "Ware," and that it cannot tuck its head and neck completely under the shell, as can the Mullentypery. It climbs out of the water on to partially submerged logs, where it may remain for considerable periods, but it feeds only in the water. The flesh is not so good as that of the Mullentypery, and, if much is eaten, sores are produced on the body.

Karloan's statement as to the sideways retraction of the head and neck, complete in *Chelodina* and partial in *Emydura*, might almost be inferred from an examination of the respective shells. In the former (fig. 2) it is free from the

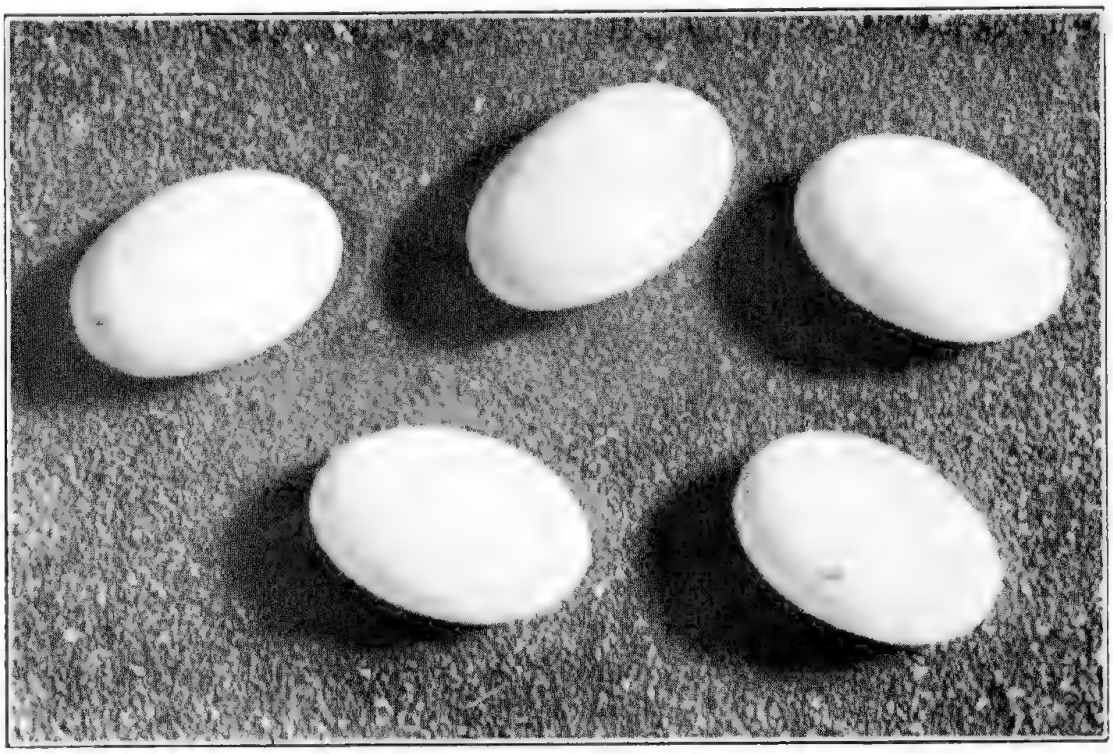


Fig. 1. Eggs of *Chelodina longicollis*. Natural size.

attachment of the skin, all round the front margin, for nearly an inch under the carapace in large examples, and about half that space above the plastron. In *Emydura* (fig. 3), though free at the sides, the skin converges forward under the carapace, and in the middle is attached just below the margin of the neural and first marginal plates on each side, whence it contracts, and therefore leaves a wider space. In the plastron the skin is attached close to the edge of the shell all the way round. The encroachment of the skin, in this species, may therefore prevent the complete retraction of the head and neck, an apparent disability not experienced by *Chelodina*.

I am told that though both tortoises are eaten by natives, *Emydura* only is relished by Europeans, and at one time, when the chelonians were more plentiful in the vicinity of our towns than they are to-day, the Murray Tortoise was regularly caught and consigned to Adelaide, where it was sold to restaurants and served as turtle soup. *Chelodina* was, on the other hand, not utilized in any way, because "it stinks horribly."

When hatched, sometimes at considerable distances from water, the young seem to instinctively make their way to the river, and *en route* are sometimes picked up by school children. This sense of direction has been attributed to the leading of falling ground, it being common alike to marine turtles, crocodiles, etc. I have kept several Murray Tortoises in my garden; when missed from their pond they were invariably to be found against the back garden fence, the ground gently sloping in that direction, and to which the reptiles wandered in evident search for more extensive waters than had been provided for them.

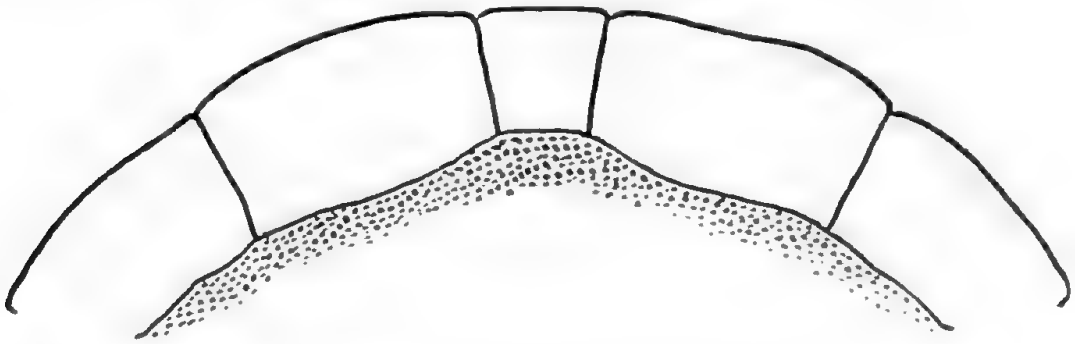


Fig. 2. Under side of front portion of carapace of *Chelodina longicollis*. The inner line represents the attachment of the skin, indicated by shading. Reduced.

There are, however, exceptions to the falling ground suggestion; in certain parts of Australia, when successions of rainy seasons are followed by periods of drought, water holes dry up, and the tortoises that may have been hatched in the vicinity, and lived in certain water holes, possibly for four or five years, are compelled to migrate. To this end they, of necessity, have to make for rising ground, and have been seen crossing ridges between low-lying pools. On a ridge between two swamps a rabbit-proof fence was erected, and later the migrating tortoises were discovered piled up dead against the wire barrier. It is alleged that tortoises eat the eggs of fishes, and at the instance of river fishermen the

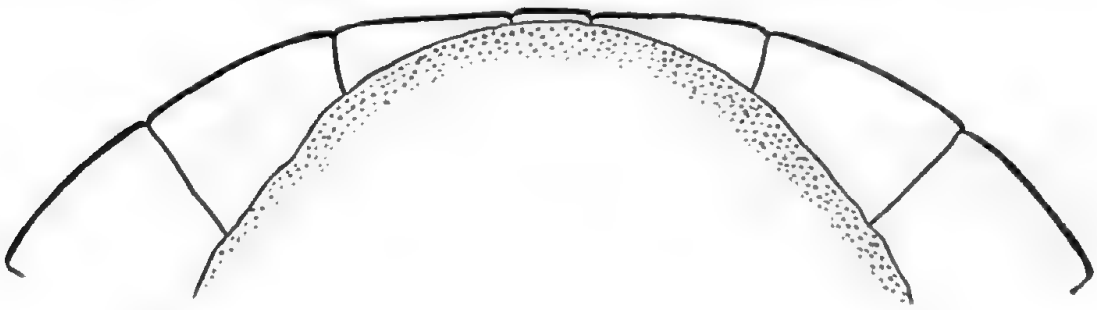


Fig. 3. Under side of front portion of carapace of *Emydura macquarii*. The inner line represents the attachment of the skin, indicated by shading. Reduced

legislature of this and other States placed a price on the tortoise, and paid a sum for each unfortunate's head. The rabbit netting above mentioned proved a copper mine to certain astute fishermen, for, according to my informant (Mr. T. P. Bellchambers), all they had to do was to walk along the fence and decapitate the already caught chelonians, for each head of which they were duly paid by an unsuspecting Government.

It might be thought that if any of our indigenous animals are to survive the onslaught of introduced foes, such would be the rather shy and well-protected water tortoises. These reptiles do not meet their foes in the water, nor are they attacked on land; the destruction is wrought on the eggs by that arch enemy, the European fox, which digs them out of their holes and destroys batch after batch.

LACERTILIA.

DTELLA, Peropus variegatus Duméril and Bibron.

Fig. 4.

Typical examples of *Peropus variegatus* Gray and *Heteronota binoei* Gray are so distinct that one would scarcely think it necessary to look twice to determine to which species a gecko might belong. Writing of the lizards of Monte Bello Islands (off Western Australia), the late P. D. Montague says that it is

Fig. 4. Eggs and young of *Peropus variegatus*, photographed on the day of emergence. Natural size.

remarkable that on Hermite Island these two species bear a strong superficial resemblance to one another both in size and colouration. The fact is interesting, as the two species are found together on the same ground, though *Heteronota*

obtains its food on the sand and *Peropus* on the bushes above. It is unfortunate that, both in the text and explanation of plates accompanying Montague's paper, an illustration of *Peropus variegatus*, as evidenced by the dilated fingers and toes and clawless inner digits, is ascribed to *Heteronota* (1). The literary references in this article are also incorrect. Montague was killed in the Great War, and doubtless did not see proofs of his paper.

The accompanying illustration, indifferent though it is, is published to show the size of the eggs and of the young, the photograph having been taken on the day on which they emerged. As soon as hatched the young ones emitted a shrill little squeak. The eggs were presented by Mr. Edwin Ashby.

SHINGLE-BACK, Trachysaurus rugosus Gray.

Figs. 5, 6.

Also called Sleepy Lizard and Stump-tailed Lizard. This reptile is very common in the mallee districts, and varies greatly in the relative amount and disposition of the brown and yellow colouration; some examples being almost

Fig. 5. Young albino of *Trachysaurus rugosus*. Reduced.

entirely brown, while in others the lighter tint preponderates. I have known of two perfect albinos, one of which, now alive, and presented to the Museum

(1) Montague, P.Z.S., 1914, p. 640, pl. 3.

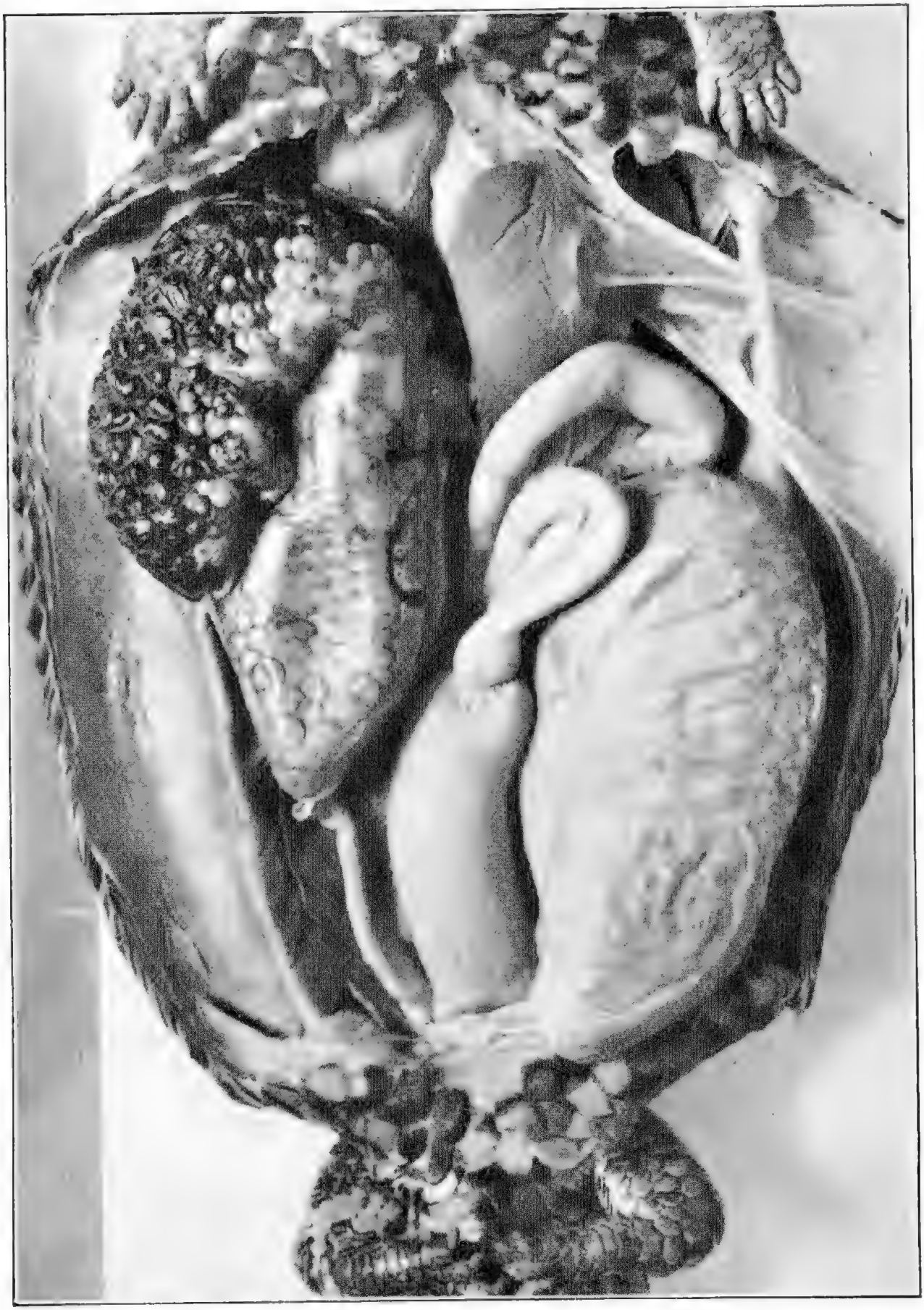


Fig. 6. Two foetuses of *Trachysaurus rugosus*, photographed *in situ*. The enveloping membranes have been removed from one of the specimens. Natural size.

by Mr. J. P. Kelly, of Monarto, is illustrated in the accompanying photograph (fig. 5). Not only is the body white and the eyes pink, but the tongue, which is normally blue, and inside of the mouth are also pink, there being everywhere an entire absence of pigment. The pineal area is clearly defined, and is well shown in the photograph; it is covered with about nine small scales.

This lizard is viviparous, and McCoy's statement ([2]) that it produces but a single young at a birth has been freely copied. Accidents will happen, even in the reptile world, and it is not impossible that on occasion one ovum only may be fertilized; my experience is that two young are produced, and the photograph (fig. 6) shows the two well-developed foetuses within the body of the mother. In one the membranes have been removed to show the markings, curvature of the body, and the position of the limbs, etc.

Lucas and Le Souëf ([3]) state that the Shingle-back has a great reputation as an inveterate enemy of snakes. No specific instances are recorded, and I fancy that the reputation is as little deserved as is that of snakes swallowing their young. This lizard is assuredly largely a vegetarian, and the berries of the native currant *(Leptomeria)* are often found in its stomach; it also eats toad stools. In captivity it readily feeds and thrives on bananas and other fruit, and eats snails quite freely. That the lizard falls a victim to snakes I know, for I have myself taken an example from the stomach of a python, which, of course, would have no difficulty in picking up the most sluggish of lizards, and of which Mr. A. G. Bolam ([4]) writes: "It moves along at almost a snail's or tortoise's pace, and consequently has great difficulty in getting out of anyone's way, particularly if it is crossing a track upon which vehicles run."

Another enemy is of more recent origin. The large, triangular head, suddenly contracted to the neck, was developed before the days of wire-netting, the introduction of which is responsible for a proportion of fatalities among the Shingle-backs. The lizard starts off to climb the rabbit-proof netting, and apparently tests the spaces as it ascends. It ultimately manages to get its head through one of the meshes, but as it can neither withdraw its head nor pass its body through the mesh, it is doomed to perish miserably. The Bearded Lizard *(Amphibolurus barbatus)* is similarly trapped, and I have on more than one occasion rescued specimens from their predicament.

([2]) McCoy, Prod. Zool. Vict., dec. xi, 1885, p. 4.

([3]) Lucas and Le Souëf, "Animals of Australia," 1909, p. 246.

([4]) Bolam, "The Trans-Australian Wonderland."

OPHIDIA.

BLIND SNAKE, Typhlops australis Gray.

Fig. 7.

The Australian members of the genus *Typhlops* were somewhat fully dealt with in the "Review of Australian Typhlopidae" (5), and to the present there

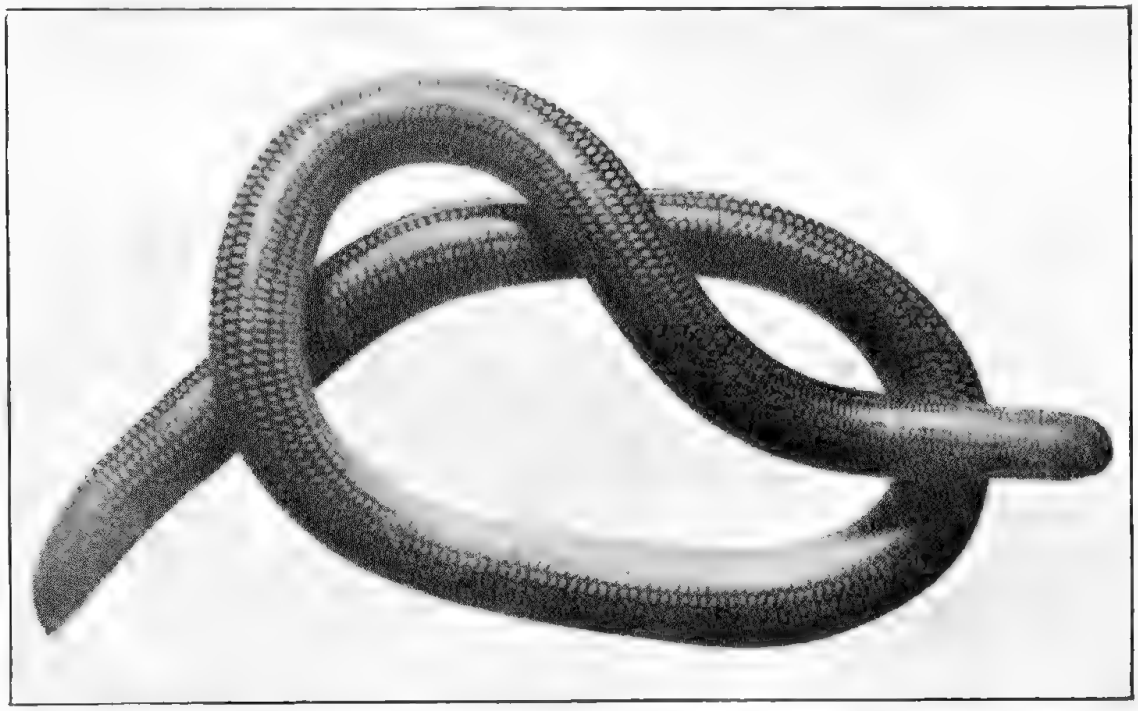


Fig. 7. *Typhlops australis.* Natural size.

is little to add. Three photographs of *T. bituberculatus*, a somewhat slender form, accompanied the paper. *T. australis* is usually of much stouter habit, and the illustration (fig. 7) represents an average example of natural size.

WOMA, Aspidites ramsayi Macleay.

Figs. 8, 9.

In my contribution to the account of the Museum Expedition to Strzelecki and Cooper Creeks (6), the Woma of the Cooper Creek natives was identified with the python *Aspidites ramsayi*, and a photograph of a dead specimen 2,388 mm. in length, was published. I am now able to present a picture of a living

(5) Waite, Rec. S.A. Mus., i, 1918, p. 1 *et seq.*

(6) Waite, Trans. Roy. Soc., S.A., xli, 1917, p. 436, fig. 4-7, and pl. xxvii, fig. 2.

example (fig. 8). The snake was obtained at Cordillo Downs, and was presented to the Museum by Prof. J. B. Cleland. It was photographed under advantageous

Fig. 8. Living example of *Aspidites ramsayi*, 7 ft. 10 in. in length.

conditions, and the picture well shows the extent and disposition of the colour markings. In the paper referred to I furnished drawings of the profile and upper part of the head of this species, and these are now supplemented by an illustration of the under-surface, as seen in the recent example (fig. 9).

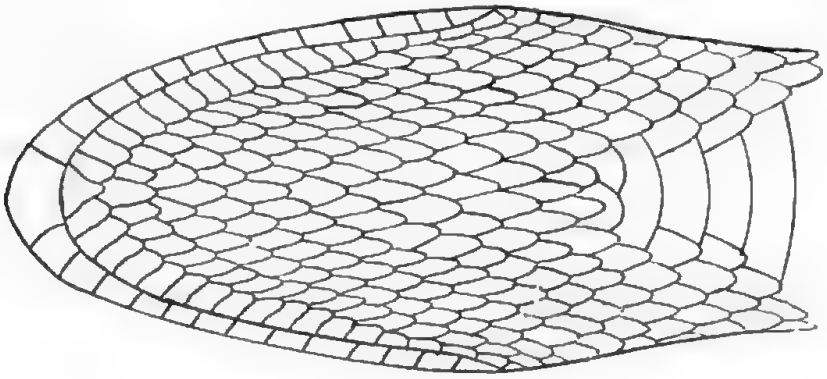


Fig. 9. Lower view of head of *Aspidites ramsayi*. Natural size.

GREY-BELLIED SNAKE, Demansia textilis, var.

Figs. 10, 11.

In January last I spent a week, in company with my colleague, Prof. F. Wood Jones, on the northern end of Coffin's Bay Peninsula, on the west coast of Eyre Peninsula. From its resemblance to a prancing, though headless, horse, the remarkable headland is also known as Horse Peninsula. What are, in winter,

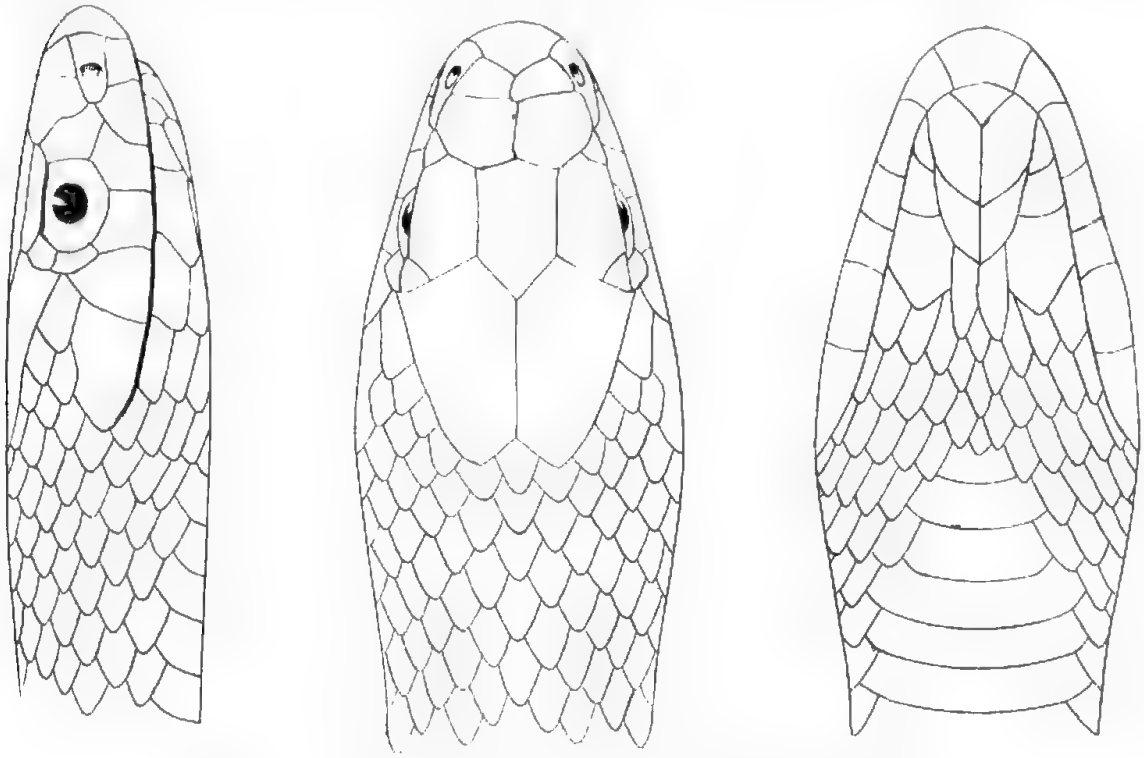


Fig. 10. Head of *Demansia textilis* var. *inframacula*. × 2.

doubtless shallow lakes become dry flats in summer, supporting low herbage only. On these flats we frequently disturbed snakes of a particularly active species, which I did not then recognize. The ground bordering the flats is riddled with rabbit burrows, into which the reptiles rapidly disappear when disturbed. The location of these burrows is evidently well known to the snakes, so that, although reasonably expert "at the game," we found it impossible to capture them alive or uninjured. The snake usually sighted us before we had discovered its presence, and disappeared down a not far distant burrow ere we could reach it. The gun was the only alternative, and all the specimens secured were shot. Several of those thus disabled were not obtained, for sometimes a snake, blown almost in two, would manage to escape; the fore portion, perhaps nine inches in length, taking with it two feet or more of body and tail, attached

by little more than a slender shred of tissue. Specimens arrested in this damaged condition put up a most determined fight, and bit savagely at anything presented to them. It was remarked that, long after the head and fore end were dead, the remaining portion of body and tail continued in vigorous reflex action.

A subsequent examination of the specimens obtained, indicates that they cannot be structurally distinguished from *Demansia textilis*, but as the remarkable colouration and ornamentation are alike in all examples seen, and notably different, especially in the lower portions, from typical specimens of our common Brown Snake, a varietal name, at least, may be accorded to the Coffin Bay Peninsula form.

Demansia textilis var. **inframacula** nov.

Figs. 10, 11.

Seven small teeth follow the fang. The horizontal diameter of the eye is twice its distance from the mouth; the rostral is wider than deep, the portion visible from above measures two-thirds its distance from the frontal; internasal suture about half that of the prefrontals; frontal slightly broader than either supra-ocular, its breadth three-fifths its length, which is equal to its distance

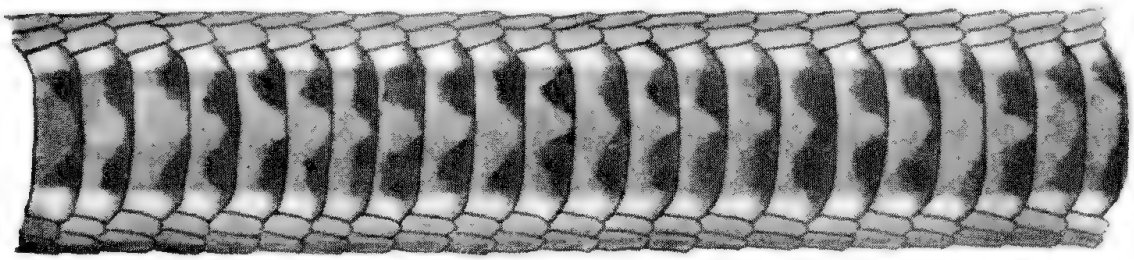


Fig. 11. Portion of ventral scales of *Demansia textilis* var. *inframacula*. (The drawing is somewhat diagrammatic, for the lower lateral scales are not visible in a ventral view, the scutes extending the entire width of the body.)

from the end of the snout; parietals very large, as long as their distance from the rostro-nasal suture; their suture equal to the length of the frontal; nasal entire in short contact with the single large preocular; two postoculars in contact with the parietal; temporals 1+2. Six upper labials, first two in contact with the nasal, third and fourth entering the eye, sixth the largest. Mental triangular. Seven lower labials, the first broadly in contact with its fellow and excluded from the third labial; the first, third, and fourth broadly, the second barely, in contact with the anterior chin shield, the suture of which is shorter than that of the first labial but longer than that of the posterior chin shield, the bifurcation of the latter pair occupied by a single scale.

Scales in 17 rows round the middle of the body, 22 round the neck; ventrals 190, forming a slight rounded ridge along each side; anal divided; subcaudals in 62 pairs, all divided.

Colours. Warm umber brown above, black patches on the head, the scales on the upper part of the body and tail interspersed with isolated black scales, which are massed on the vertebral line, forming a double row, or, in parts, a single row only. The ventrals above the slight angularity are paler than the upper surface, their median portion is dark grey; on the throat and fore part of the body, the grey ground colour is largely obscured with black, which, further back, divides, forming on each scute two black patches, usually separated on the median line as illustrated in fig. 11. The condition of the markings is continued under the tail, but after the first inch they again become median.

Total length, 1,055 mm.; tail, 190 mm.

In a second specimen, 960 mm. in length, in which the tail is 160 mm., there are 198 ventral scutes, and the subcaudals are in 58 pairs.

The unfamiliar appearance of this snake, coupled with the circumstance that all specimens seen were identical in colouration, suggested that it was a species hitherto undescribed. As, however, it exhibits no external structure differing from *D. textilis*, it is regarded as a melanotic variation developed locally under almost insular conditions.

Albinism appears to be rare in snakes, though a cobra and others have furnished examples. Melanism, on the other hand, is not uncommon, at least in some of our species. Examples of our common Black Snake *(Pseudechis porphyriacus)*, normally distinguished by its characteristic red belly, are not infrequently found, in which the red is replaced by dark grey. On Eyre Peninsula, and on the southern portions of this State, melanotic varieties of the Tiger Snake *(Notechis scutatus)* are frequently met with, while on Franklin Island, Kangaroo Island, and in Tasmania this is the dominant form. Mr. Kinghorn has distinguished specimens from Kangaroo Island by the varietal name *N. scutatus* var. *niger* (7). A melanotic variety of *D. textilis* is now added and, though so apparently distinct, the black markings of the ventral scutes may be correlated with the smaller pale red or brown spots so often seen in the Brown Snake, especially in young examples. Melanism on the dorsal surface is expressed in the blackening of certain scales, more particularly of those on or near the vertebral line.

(7) Kinghorn, Rec. Aust. Mus., xiii, 1921, p. 115, pl. xxvi, fig. 6-8, and xiv, 1924, p. 165, fig. 2, 3.

BLACK-NAPED SNAKE, Denisonia gouldii Gray.

Figs. 12, 13.

Though Flinders Island, in the Nuyts' Archipelago, has been several times visited by collectors, no snake has hitherto been recorded therefrom.

In March last, however, the omission was remedied by the agency of Mr. W. S. Bascomb, who brought to the Museum a small snake, taken on Flinders Island, and the only specimen he has seen there.

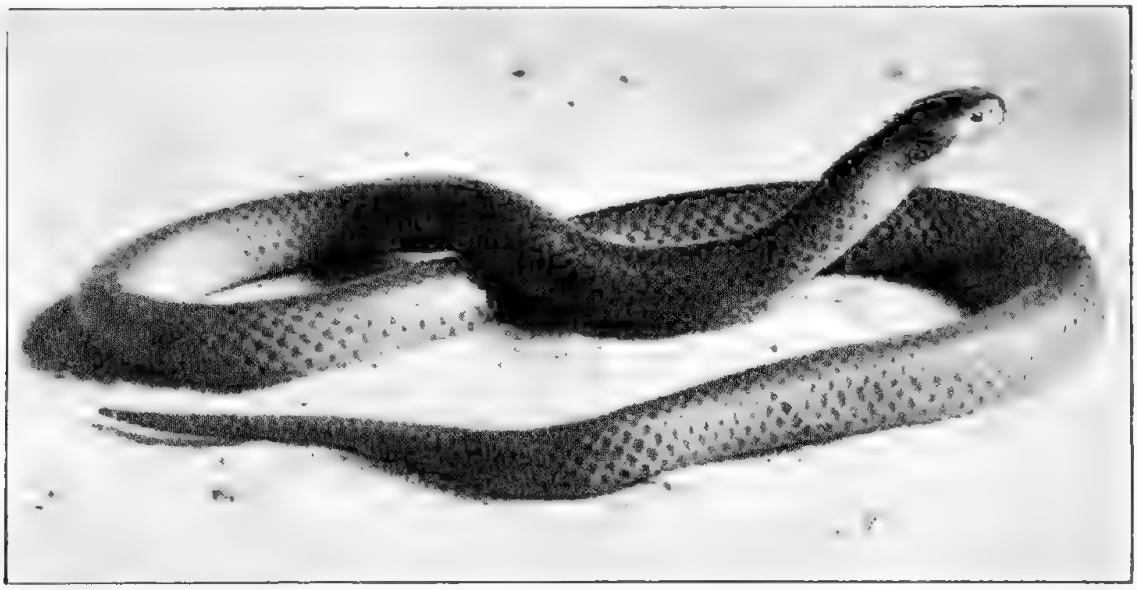


Fig. 12. *Denisonia gouldii* taken on Flinders Island. Natural size.

It proves to be an example of *Denisonia gouldii*, the colour markings being typical of South Australian examples, in which the anterior half of each scale on the back and sides is black. In the Flinders Island example the three median dorsal scales are entirely black, so that a black vertebral line arises from the characteristic hood, and is continued along the whole length of the body; on the tail the line is confined to one scale in width, there being only four scales around its hinder part, and the terminal scale is twice as long as the others, and undivided, like a ferule of a walking-stick.

A photograph of the specimen is shown in fig. 12, and drawings of the head scales in fig. 13.

In connection with the name Nuyts' Archipelago, used above, opportunity may here be taken to correct an error in a former paper of mine ([8]). In dealing

([8]) Waite, Trans. Roy. Soc., S.A., xlvii, 1923, p. 127.

with the snakes of St. Francis Island, I pointed out that, as the name of the Dutchman after whom the group was designated was not Nuyt, but Nuyts, the

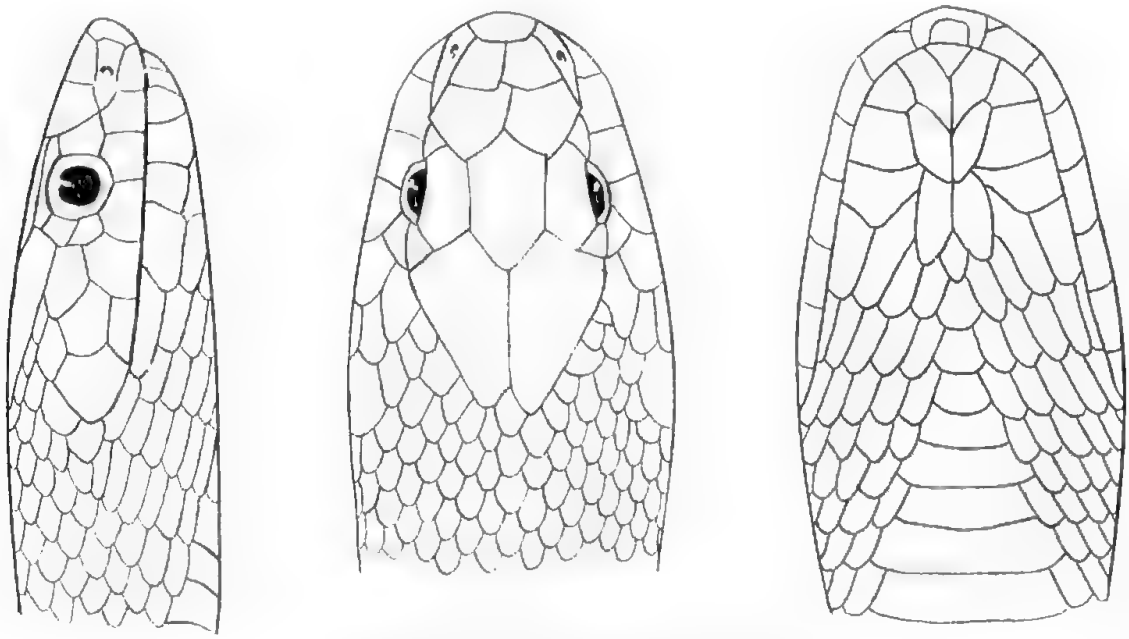


Fig. 13. Head of *Denisonia gouldii*, × 3.

name of the group should be Nuyts' Archipelago. Unfortunately, the final apostrophe was dropped after my revision, and the paragraph, as printed, thus became meaningless.

DESERT BANDED SNAKE, Rhynchelaps bertholdi Jan.

Figs. 14, 15.

Travellers by the Transcontinental East-West Railway arrive at Adelaide or Perth not infrequently with a small reptile as an addition to their luggage. It is usually a lizard, less commonly a snake. The train is met at several of the stations *en route* across the treeless plains by small parties of natives, who offer for sale or exchange for tobacco, specimens of the reptiles. The lizard is *Moloch horridus*, the snake *Rhynchelaps bertholdi*, perhaps the prettiest of all our snakes, its colour varying from pale yellow to reddish orange, crossed with about thirty black bands.

Advantage was taken of the arrival of a recent specimen to obtain the photograph here reproduced natural size (fig. 14), and to furnish drawings of the head shields (fig. 15).

Fig. 14. *Rhynchelaps bertholdi*. Natural size.

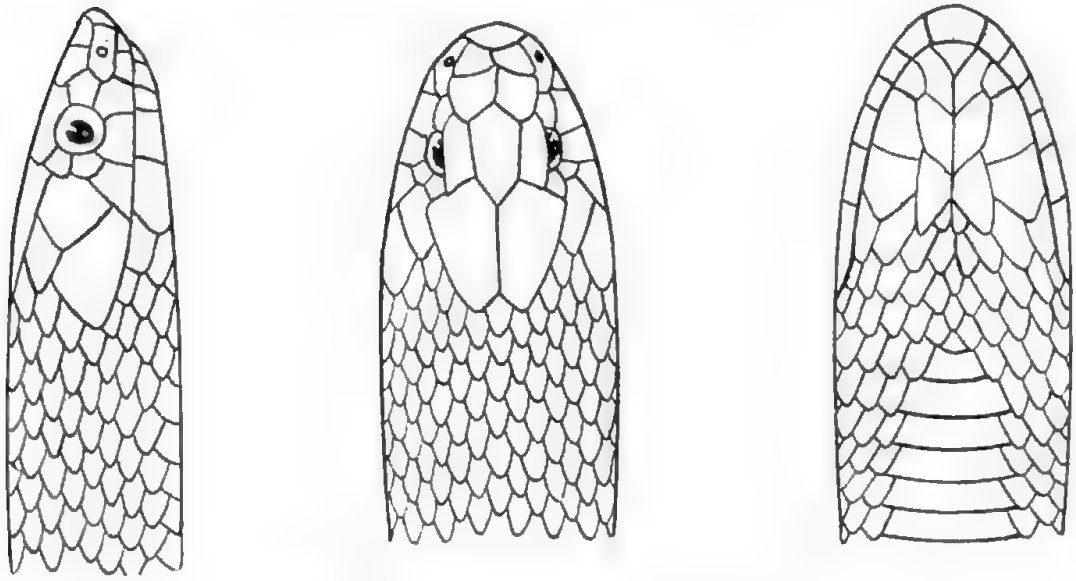


Fig. 15. Head of *Rhynchelaps bertholdi*, × 4.

BATRACHIA.

SWAMP FROG, Limnodynastes dorsalis Gray.

This frog is common on the swamps of Flinders Chase, Kangaroo Island, where the water in some cases is so shallow that the tracks made by the frogs, in

swimming, remain visible for days, the swish of the legs disturbing the surface layer of extremely fine mud. An attempt to wade the swamp results in one sinking to the knee, and sometimes deeper, in the treacherous mud.

The frogs appear to enjoy a quiet bask in the warm water, squatting on the mud with their heads above the surface; when disturbed they plunge into the soft mud and disappear from sight, but a sudden dash with the edge of the net to a depth of five or six inches will generally secure them.

Leeches abound in the water, and every frog I saw had several of these annelids attached to it. Pairing frogs, being unable to rid themselves of the temporary parasites, had, literally, scores of leeches attached to their bodies, like so many streamers.

If the swamps were visited in the post-breeding season of the frogs, there is little doubt that leeches would be found attached to the tadpoles also, as in the case of larvae seen elsewhere.

Addendum.

After writing the foregoing I received, by courtesy of Miss Procter, her paper on living snakes ([9]), in which she describes and illustrates an albino example of the Indian Cobra. She writes: "Albino snakes are excessively rare, and, although individuals of various species have been recorded from time to time, I cannot find any reference to an albino Cobra." My reference to such a one was culled from two illustrations of an individual published in the London "Times" (weekly) of September 1, 1924, and they obviously relate to the specimen later figured by Miss Procter.

([9]) Procter, P.Z.S., 1924, p. 1125, pl. 1.

NOTES ON AUSTRALIAN CRUSTACEA NO. IV

BY HERBERT M. HALE, ZOOLOGIST (CRUSTACEA), SA MUSEUM

Summary

The following species has now to be added to the recently reviewed Isopoda-Valvifera of South Australia.

Family Astacillidae. Neastacilla Tattersall. Neastacilla Tatt., "Terra Nova", Zool., iii, 1921, p. 243; Hale, Trans. Roy. Soc., S. Aust., xlviii, 1924, p. 212.

NOTES ON AUSTRALIAN CRUSTACEA.

No. IV.

By HERBERT M. HALE, Zoologist (Crustacea), South Australian Museum.

Fig. 16.

The following species has now to be added to the recently reviewed Isopoda-Valvifera of South Australia.(1)

Family ASTACILLIDAE.

NEASTACILLA Tattersall.

Neastacilla Tatt., "Terra Nova," Zool., iii, 1921, p. 243; Hale, Trans. Roy. Soc., S. Aust., xlviii, 1924, p. 212.

NEASTACILLA DEDUCTA sp. nov.

♂ Form slender. Cephalon about as long as greatest width, with anterior margin excavate, very slightly bisinuate. Eyes distinct, moderately large. First antennae reaching almost to middle of length of third article of

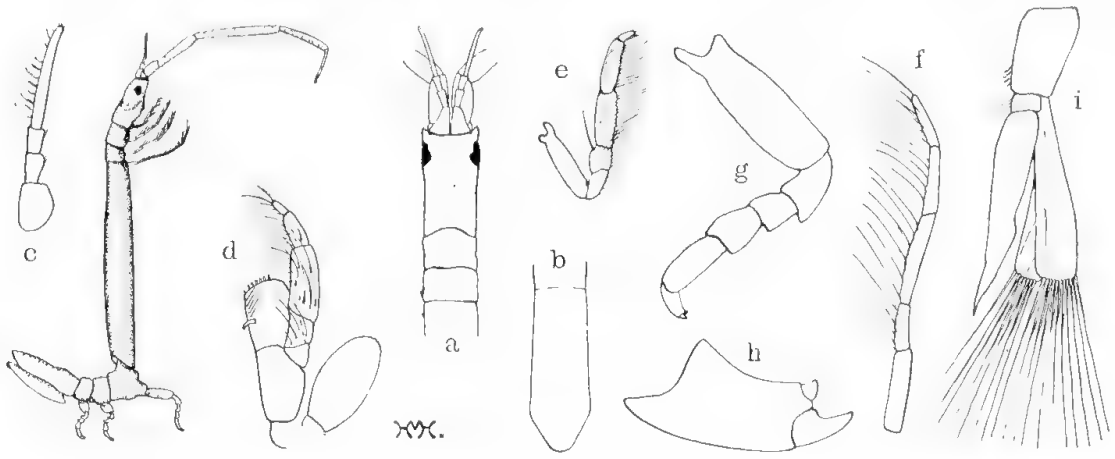


Fig. 16. *Neastacilla deducta*, male (4 diams.); *a*, dorsal view of cephalon and first three peraeon segments (8 diams); *b*, dorsal view of pleon (8 diams.); *c*, first antenna (19 diams.); *d*, maxilliped (38 diams.); *e*, *f*, and *g*, first, fourth, and fifth peraeopods (19 diams.); *h*, dactylus of fifth peraeopod (95 diams.); *i*, first pleopod (38 diams.).

second antennae; basal article of peduncle stoutest, almost as long as second and third together; third article a little shorter than second; flagellum slightly longer than peduncle, with sensory appendages on lateral margin. Second antennae a

(1) Hale, Trans. Roy. Soc., S. Aust., xlviii, 1924, pp. 209-225.

little compressed; first article short, but extending past anterior margin of head; second about half as long as third, which is equal in length to fifth, and less than two-thirds as long as the fourth article; flagellum two-thirds as long as last article of peduncle, composed of three joints and an elongate terminal style. Maxillipeds with slender five-jointed palp; basipodite broad, with inner lobe wide and furnished with a few short, setose spines along distal margin and five longer spines at anterior half of inner margin; epipodite large, sub-oval in shape. Peraeon sub-cylindrical; first segment fused with the cephalon, and with infero-lateral margins scarcely expanded downwards; second and third segments sub-equal in length; fourth very long, more than three times as long as first three together, and one-half total length of animal exclusive of the antennae; fifth, sixth, and seventh segments decreasing in length backwards. Four anterior pairs of peraeopods slender, fringed with long, fine hairs; first pair the shortest; three posterior pairs moderately strong. Pleon unisegmentate, little more than one-third as long as fourth peraeon segment; in dorsal view the lateral margins are sub-parallel for the greater part of their length, the postero-lateral margins are slightly tumid, and the apex of the telson is rounded. Male appendage of first pair of pleopods stout, longer than the narrow natatory rami, and tapering to an acute apex; male stylet of second pair slender, longer than the rami.

Colour, after long preservation in alcohol, green.

Length, 12 mm.

Hab. South Australia: Port Adelaide, "clinging to a buoy" (W. H. Baker). (Type, South Aust. Mus., Reg. No. C. 273.)

The male described above and a smaller specimen were secured. The species is close to *N. algensis* Hale [2], but differs in having no dorsal tubercle on the cephalon, in the different relative proportions of the articles of the second antennae, and in the stouter posterior peraeopods.

[2] Hale, *loc. cit.*, p. 212.

NOTES ON SOME CALCAREOUS INSECT PUPARIA

BY ARTHUR M. LEA, F.E.S., ENTOMOLOGIST, SA MUSEUM

Summary

From time to time the South Australian Museum acquired specimens of roughly elliptic calcareous cases or nodules, measuring up to 2 ½ x 1 ¼ inches, and weighing up to 3 ounces. Similar cases have several times been exhibited at meetings of the Royal Society of South Australia. The cases may be seen in abundance for about 300 miles of the South Australian coast up to the West Australian border, and for about 40 miles inland. In colour they vary from pale buff to a rather dirty greyish-white or dingy cream. The outer surface, except for slight inequalities, may be either smooth to the touch, like a rather coarse chalk, or harsh, caused by sand and other grit.

NOTES ON SOME CALCAREOUS INSECT PUPARIA.

By ARTHUR M. LEA, F.E.S., Entomologist, South Australian Museum.

Plate I.

From time to time the South Australian Museum acquired specimens of roughly elliptic calcareous cases or nodules, measuring up to 2½ x 1¼ inches, and weighing up to 3 ounces. Similar cases have several times been exhibited at meetings of the Royal Society of South Australia. The cases may be seen in abundance for about 300 miles of the South Australian coast up to the West Australian border, and for about 40 miles inland. In colour they vary from pale buff to a rather dirty greyish-white or dingy cream. The outer surface, except for slight inequalities, may be either smooth to the touch, like a rather coarse chalk, or harsh, caused by sand and other grit.

It was assumed that they were pupal cases or cocoons of insects, that had been altered by the action of lime water; but of what insect was unknown till recently, when Mr. J. R. Ryan, of Ceduna, who had brought in many of the specimens, sent others which proved that the original cases, or at least many of them, were constructed by large weevils, *Leptops duponti*, some of them being actually in their original cases. Mr. Ryan wrote: "They are found almost everywhere on the coast, inland as well as near the seaside, and can be dug up just under the surface of the ground. Those I gathered were mostly lying on the ground as I happen to walk across them. In sandy country, where the limestone is not so plentiful, these shells are only half the weight of those where it is plentiful. They are so delicate that once they are touched they crumble to dust. Before being handled they look similar to the others, except for colour and smaller size."

Many of the cases are solid, without any indications of openings, but on cutting through such cases the original cavity is clearly indicated (figs. 17, 20); the majority, however, have a large circular opening near one end (figs. 3, 8, 9), either complete (in which condition the case is hollow), or indicated only (figs. 1, 4), the inside being filled with sand solidified by infiltrations of lime. Some of the cases have small holes, present or indicated, and the suggestion has been made that these were due to escape holes of parasites, and where no large exit holes are present, probably this is the case.

The majority of cases are those of *Leptops duponti*, but other large members of the genus are doubtless also responsible. The specimens in which the large opening is terminal or subterminal may be ascribed to such. Probably many of

the smaller cases (figs. 10-14) are due to other insects, as in these the large opening is median. It is probable that some of these were caused by cockchafers (Scarabaeidae) and other beetles that habitually pupate in the ground.

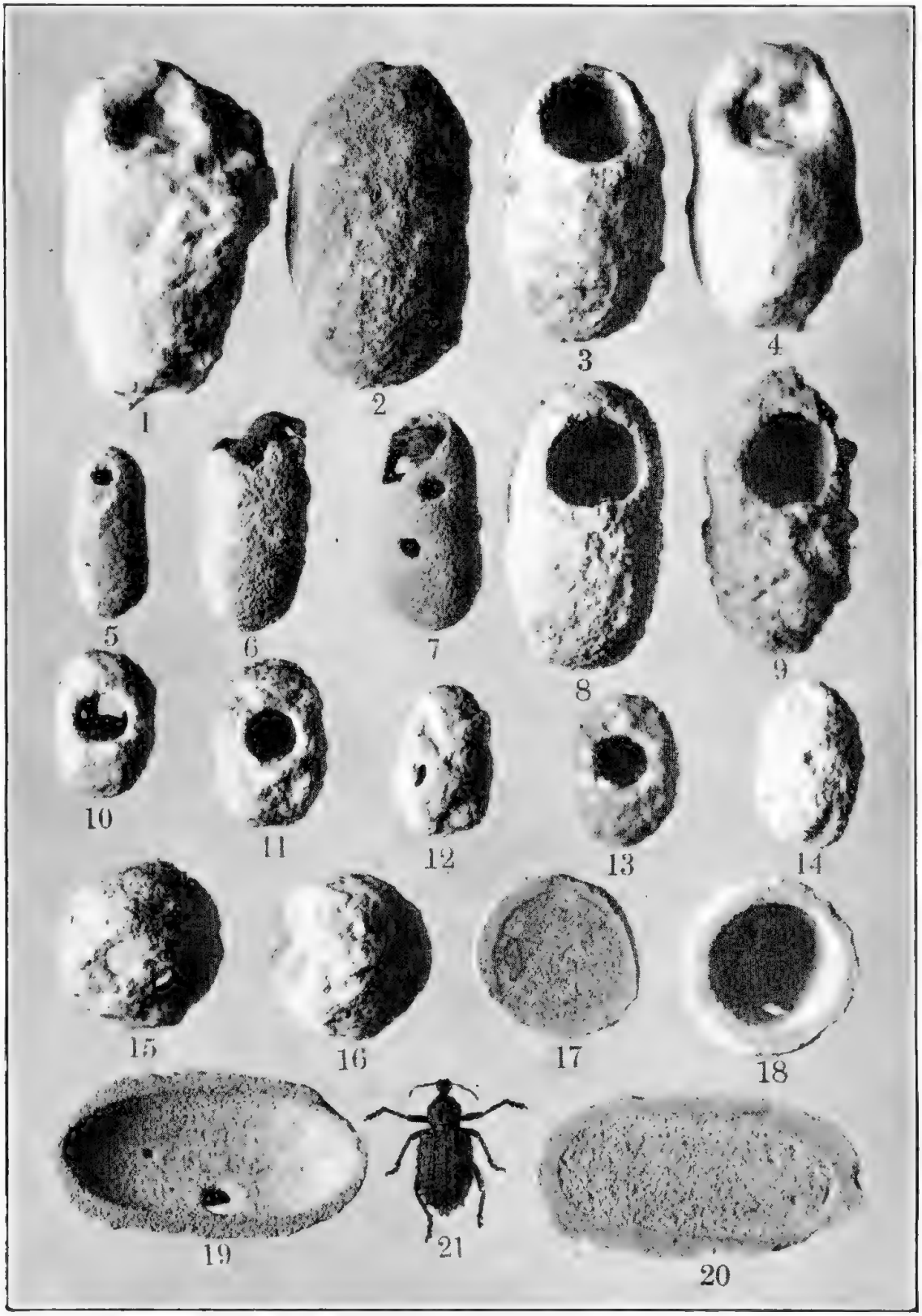
In most parts of Australia the pupal cases would no doubt soon disintegrate, but in the districts where the heavy cases occur, in all of which travertine limestone is present, they are prevented from doing this by the infiltration of lime. Mr. Edgar R. Waite and Prof. F. Wood Jones at Coffin Bay recently saw many of the cases on the surface, with indications that they had been thrown up by burrowing rabbits; but probably many of them are of considerable antiquity and have been exposed and covered many times.

Leptops duponti is a rough, wingless weevil, widely distributed in Australia (in many works dealing with Australian entomology it is referred to as *L. tribulus*, but that species, from the type in the British Museum, is now known to be a much smaller species, and is confined to Queensland). It may be obtained on wattle trees of many kinds, and its larvae are believed to feed on their roots; it varies greatly in size, and several varieties are known.

Explanation of Plate I.

(Photograph by N. B. Tindale.)

Figs. 1, 4. Cases with end openings almost filled.
Fig. 2. Case completely filled.
Figs. 3, 8, 9. Empty cases with large exit holes.
Fig. 5. Small case with small end hole.
Figs. 6, 7. Brittle cases with *Leptops duponti (in situ)*.
Figs. 10, 11, 13. Small empty cases with large hole in middle
Figs. 12, 14. Small filled cases.
Figs. 15, 16. Ends of large cases.
Fig. 17. Large case cut across to show filling.
Fig. 18. Large empty case cut across.
Fig. 19. Large empty case cut lengthwise.
Fig. 20. Large case cut lengthwise to show filling.
Fig. 21. *Leptops duponti* Boisd



CALCAREOUS COCOONS.

ON A NEW PLOEOTHRIPS (THYSANOPTERA) FROM NORFOLK ISLAND

BY H. H. KARNY, BUITENZORG, DUTCH EAST INDIES

Summary

When at Norfolk Island in 1915, Mr. A. M. Lea, Entomologist, of the South Australian Museum, collected some Thysanoptera, which were later sent to Dr. Bergroth, who is describing one of the species under the name Phloeothrips sanguinolentus. Two tubuliferous specimens, also collected by Mr. Lea, were sent to me by Dr. Bergroth, and these likewise prove to be new. They may be known as: Phloeothrips Leai sp. nov.

On a New *Phloeothrips* (Thysanoptera) from Norfolk Island.

By H. H. Karny, Buitenzorg, Dutch East Indies.

Fig. 17.

When at Norfolk Island in 1915, Mr. A. M. Lea, Entomologist, of the South Australian Museum, collected some Thysanoptera, which were later sent to Dr. Bergroth, who is describing one of the species under the name *Phloeothrips sanguinolentus*. Two tubuliferous specimens, also collected by Mr. Lea, were sent to me by Dr. Bergroth, and these likewise prove to be new. They may be known as:

PHLOEOTHRIPS LEAI sp. nov.

General colour blackish-brown, tube slightly paler distally. Fore tibiae dark yellow, infuscated in the middle part, especially along margins; middle and hind ones blackish-brown, broadly yellow at base, narrowly yellow at apex. All tarsi yellow. Antennae as dark as body; second joint slightly paler distally, third yellow in basal half, fourth in basal third, fifth at extreme base (pedicel).

Head somewhat longer than wide. Cheeks strongly protruding near the hind margin of eyes, thence almost straight, converging backwards and densely set with small granules, the larger of which bear short bristle-spines, the hindermost of which are longer and stronger than the others. Postocular bristles shorter than their distance from the cheeks, strongly dilated at apex. Ocelli arranged in an equilateral triangle. Eyes moderately large, not prominent, produced further backwards on dorsal than on ventral surface. Forehead slightly produced in front of the eyes.

Antennae short and thick, not quite twice as long as head. Middle joints clavate, eighth conical, broadly united with seventh; seventh and eighth together fusiform. Sense-area of second joint placed beyond the middle. Sense-cones on joints three and four thick, moderately short, those on fifth and sixth longer and more slender. Formula: III, 1-2; IV, 2-2; V, 1-1; VI, 1-1; VII with one on dorsum near apex.

Mouth cone long, acutely pointed, reaching across prosternum. Maxillary palpi slender, moderately long, basal joint not longer than wide, apical joint about seven times as long as wide, set with some stiff sense-bristles near apex. Labial palpi slightly *longer* than maxillary palpi, with basal joint twice as long

as wide, and one-half as long as apical joint, the apex of which is set with stiff bristles.

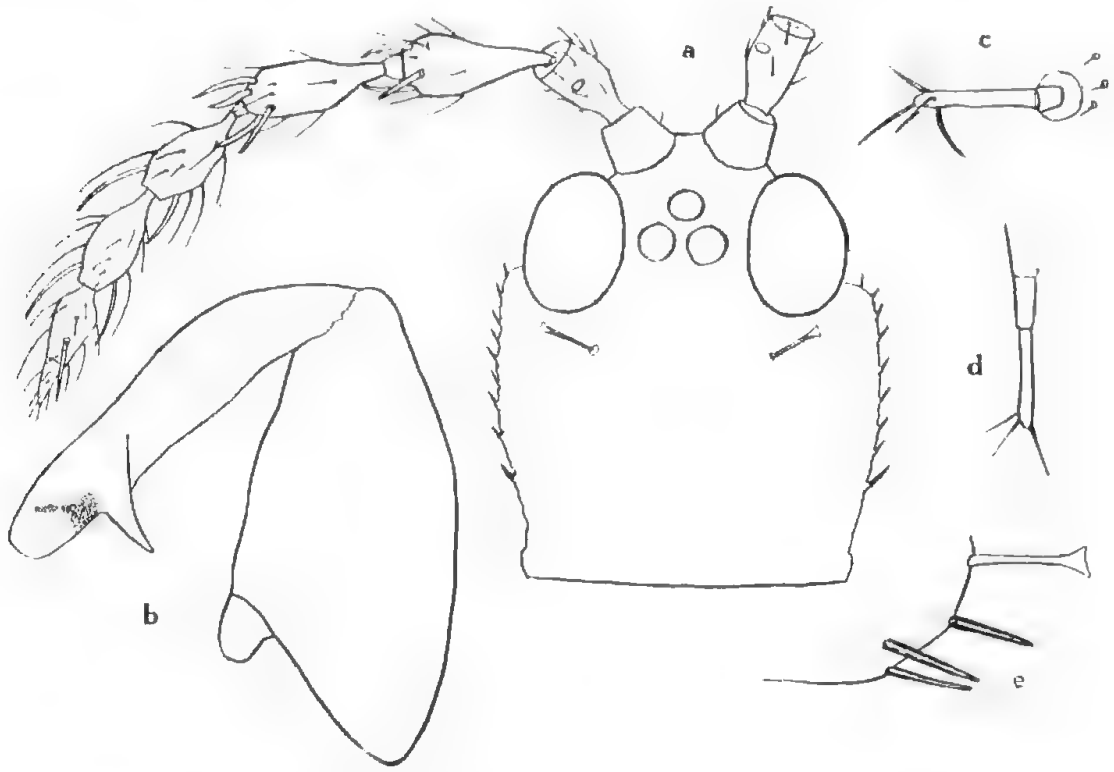


Fig. 17. *Phlocothrips lati*—a, head; b, fore leg; c, maxillary palpus; d, labial palpus; e, bristles on fore coxa, c, d, e more enlarged than a and b.

Prothorax moderately large, shorter than head, across fore coxae nearly twice as wide as long. Owing to the dark colour of prothorax, antero- and postero-marginal bristles are not visible. All other bristles well developed, strongly dilated at apex; anterolaterals about twice as long as the postoculars, mediolaterals somewhat shorter, posterolaterals somewhat longer, about half as long as prothorax. Near the anterolaterals, there is a very short, forwardly directed, pointed bristle at each anterior angle.

Fore coxae, near the hind angle of femur, with a short, hyaline bristle, which is strongly dilated at apex, and is about as long as the postoculars. Behind it there are three shorter, thick, dark, pointed bristles. Fore femora incrassate, about twice as long as wide, without teeth. Fore tibiae thick, slightly swollen in the middle, not toothed. Fore tarsi with a strong, slightly curved tooth.

Pterothorax slightly wider than long, constricted at hind margin of mesothorax; metathorax dilated backwards. Wings very slightly constricted in the middle, almost parallel-sided, reaching to about the sixth or seventh abdominal segment, not densely fringed, slightly infumate, hind wings especially so along median vein. Eight to twelve interlocated cilliae.

Abdomen about as wide as pterothorax, about two and one-half times as long as wide. Segments, near each hind angle, with two hyaline, distally dilated bristles, and with one shorter, darker, pointed bristle; the dilated bristles on segments seven and eight are about as long as the segments themselves, on the preceding segments shorter (most of them broken off in the two specimens before me); ninth segment near each hind angle with about four pointed bristles (none dilated), the longest of which is hardly more than half as long as tube. Wing-retaining spines well developed on segments two to seven, S-curved; fore pair weak, shorter than the hind pair; hind ones on middle segments about as long as the distance of their tips, or even a little longer, on segments two and seven shorter. Tube two and one-half times as long as wide at base, at apex slightly more than half as wide as at base; sides straight, converging distally. Terminal bristles hair-like in distal half; the longer ones about two-thirds the length of tube, and three times as long as the shorter ones.

Measurements. Antenna, total length, 0·45 mm.; I joint, 0·05 x 0·045 mm.; II joint, 0·06 x 0·03 mm.; III joint, 0·08 x 0·04 mm.; IV joint, 0·08 x 0·04 mm.; V joint, 0·065 x 0·03 mm.; VI joint, 0.055 x 0·03 mm.; VII joint, 0·045 x 0·027 mm.; VIII joint, 0·023 x 0·013 mm. Head, 0·27 x 0·23 mm. Prothorax, 0·21 x 0·37 mm. (across fore coxae). Fore femora, 0·27 x 0·13 mm.; fore tibiae (incl. tarsi), 0·23 x 0·05 mm. Pterothorax, 0·33 x 0·36 mm. Middle femora, 0·17 x 0·06 mm.; middle tibiae (incl. tarsi), 0·23 x 0·05 mm. Hind femora, 0·24 x 0·075 mm.; hind tibiae (incl. tarsi), 0·33 x 0·05 mm. Length of wings (without fringe), 1·0 mm. Abdomen (incl. tube), 1·0 x 0·37 mm. Length of tube, 0·18 mm.; width at base, 0·07 mm.; width, 0·04 mm.. Total length, 1·8 to 1·9 mm.

I have pleasure in naming this species—the first Thysanopteron known from Norfolk Island—in honour of its collector, Mr. A. M. Lea.

This species belongs to the *annulipes* group in Priesner's key (1), and is between *salicinus* and *parvus*, but differs from the others of the group (all European) especially by the shape of the head and antennae and by the stronger fore femora.

Norfolk Island (A. M. Lea): 1 type (♀) and 1 cotype (perhaps ♂).

The specimens were carded when I got them, and are now in balsam slides.

(1) Priesner, Tijdschr. v. Entom., lxvi, 1923, pp. 96-103.

ODONATA, NEUROPTERA AND TRICHOPTERA FROM GROOTE EYLANDT, GULF OF CARPENTARIA

BY R. J. TILLYARD, M.A., SC.D. (CANTAB.), D.SC. (SYDNEY), F.R.S., F.N.Z. INST., F.L.S., F.G.S., F.E.S., C.M.Z.S., ENTOMOLOGIST AND CHIEF OF THE BIOLOGICAL DEPARTMENT, CAWTHRON INSTITUTE, NELSON, N.Z.

Summary

Groote Eylandt is a large island lying in the western portion of the Gulf of Carpentaria, off the coast of Arnhem Land, at about latitude 14 degrees south. The collection of ninety specimens dealt with in this paper was made by Mr. N. B. Tindale. The collections were made in 1921-1922, and except for three specimens of the common Diplacodes bipunctata Br., two of which were taken on the smaller Woodah Island and one on Bickerton Island, all the specimens are from Groote Eylandt.

ODONATA, NEUROPTERA AND TRICHOPTERA FROM GROOTE EYLANDT, GULF OF CARPENTARIA.

By R. J. TILLYARD, M.A., Sc.D. (Cantab.), D.Sc. (Sydney), F.R.S., F.N.Z. Inst., F.L.S., F.G.S., F.E.S., C.M.Z.S., Entomologist and Chief of the Biological Department, Cawthron Institute, Nelson, N.Z.

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Order ODONATA.

Sub-Order ZYGOPTERA.

Usually written Coenagrionidae, but the stem of *Agrio* (Greek — a wild thing) is *agri-*, hence *Coenagriidae* is correct.

Family COENAGRIIDAE.

ACIAGRION FRAGILIS Till.

One female. A rare species, only known hitherto from North Queensland.

CERIAGRION ERUBESCENS Sel.

Three females. Not uncommon on reedy backwaters and billabongs from Port Darwin and Cape York to as far south as Brisbane. The females are sometimes reddish, sometimes greyish brown; the males are red.

AGRIOCNEMIS sp. indet.

Three females in very bad condition, and one broken specimen without abdomen. Probably females of the common *A. pygmaea hyacinthus* Till, but their condition does not allow of accurate determination.

Family LESTIDAE.

AUSTROLESTES ALBICAUDA McL.

One male, three females. These specimens are assigned provisionally to this species, with which they agree in the form of the male terminal appendages. The colouration of the male, however, is much darker than that of the specimens which I have examined from North Queensland, and the appendages are

uniformly dark all over; the thorax is much darker, the head also darker, but with pale blue labrum; the abdomen has segment 10 pale bluish. As this form is probably a distinct race, I name it race *tindalei*, after its discoverer. The type form of this species is found from Aru Islands to North Queensland, along the margins of lagoons and billabongs.

SUB-ORDER ANISOPTERA.

FAMILY AESCHNIDAE.

ANAX GUTTATUS Burm.

One male. A large and handsome species which flies rapidly over lagoons and billabongs throughout Northern Australia.

GYNACANTHA ROSENBERGI Br.

One female. Common throughout Northern Australia; it has a habit of frequenting shady places, and usually flies towards dusk. I have taken it in thick mangrove swamps and also in railway tunnels, and numbers have been obtained at lights at night.

FAMILY LIBELLULIDAE.

AGRIONOPTERA INSIGNIS ALLOGENES Till.

Three males, four females. This subspecies occurs fairly commonly throughout Northern Australia and the Aru Islands.

LATHRECISTA ASIATICA FESTA Sel.

One female. The male has a bright red abdomen; the female is dull brownish. A handsome species with a well-marked Northern Australian subspecific form.

ORTHETRUM V. VILLOSOVITTATUM Br.

One male. The Australian subspecies of this very common species is found as far south as southern New South Wales. The bright red males are very handsome.

NEUROTHEMIS S. STIGMATIZANS Fabr.

Seventeen males, eighteen females. A handsome species common throughout Northern Australia. The teneral males have the wings pale fulvous, with pale straw-colour pterostigma; in the mature males the wings are rich chestnut-brown and the pterostigma pink. The females are quite different, with median and apical brownish patches on the wings; these are generally more clearly marked in teneral than in mature specimens, and the pterostigma is coloured as in the males.

DIPLACODES TRIVIALIS Ramb.

One female. A common Oriental species which extends as far as Queensland.

DIPLACODES BIPUNCTATA Br.

Two males; also two females from Woodah Island and one female from Bickerton Island. One of the commonest of Australian dragonflies.

NANNODIPLAX RUBRA Kby.

Three females, one male. Not uncommon throughout Northern Australia.

TRAMEA LIMBATA Desj.

One male. This species is not so common in Australia as the closely allied *T. loewii* Br., but it occurs throughout the tropical parts, and also extends right down into South-western Australia.

RHYOTHEMIS BRAGANZA Karsch (R. ALCESTIS Till).

Four males, two females. A rare species, recorded only from Darwin and North Queensland. Karsch mistakenly described his type specimen as from Brazil; hence the unsuitable name.

ORDER NEUROPTERA.

SUB-ORDER PLANIPENNIA.

FAMILY CHRYSOPIDAE.

CHRYSOPA sp. indet.

One specimen in very bad condition.

FAMILY MANTISPIDAE.

MANTISPA STRIGIPES Westw.

One specimen. In general form and venation this specimen agrees with the type, but the forelegs are entirely rufous, without any dark mark on the inside of the femora. I therefore name it var. *rufipes*.

FAMILY OSMYLIDAE.

CONCHYLOSMYLUS TRISERIATUS Banks.

One specimen, somewhat damaged; right forewing broken off at half-way, left forewing damaged. An exceedingly rare species, only known from two other specimens, the type from Herberton and a second specimen from Stannary Hills, both in North Queensland. The general colour, pale yellowish, is exceptional for an Osmylid; the forewing carries, at about one-third of its length along the posterior margin, a small oval raised patch or bulla, yellowish brown in colour, and crossed by four dark brownish veinlets.

FAMILY MYRMELEONTIDAE.

PROTOPLECTRON VENUSTUM Gerst.

One immature specimen, somewhat damaged. This species is recorded from scattered localities in the drier parts of Australia.

DISTOLEON SOMNOLENTUS Gerst (D. VERTICALIS Banks).

Two specimens, in fair condition. Widely spread throughout the drier parts of Australia, but nowhere common.

BRACHYLEON DARWINI Banks.

Two specimens. A very rare species, only recorded previously from Darwin. Easily recognized by its small size and by the short, dark, longitudinal stripe on the hindwings.

MYRMELEON UNISERIATUS Gerst.

Two specimens. This is the commonest of the pit-forming species in Australia, the larva and its conical pitfalls occurring under almost every raised house in Queensland; less common in New South Wales.

MYRMELEON PICTIFRONS Gerst.

One specimen. A close ally of the preceding, with similar habits, except that the larva more often makes its pitfall in loose sand in the open. Distinguished by the more pointed wings and the black V-mark on the pale face.

MYRMELEON CROCEICOLLIS Gerst (M. LOWERI Till).

One specimen with left forewing broken. A rare species, distinguished by the pale yellow prothorax. Known from as far south as Broken Hill.

FAMILY ASCALAPHIDAE.

SUHPALACSA DIETRICHIAE Br.

Two specimens, both females. A rather rare species, confined to Northern Australia.

The correct spelling of the genus is as above, the name having been given as a complete anagram of the word *Ascalaphus;* even the Greek consonant ϕ was written backwards as "hp". An inexcusable joke, but it has priority over all suggested amendments! The idea was, evidently, to commemorate the antipodean character of the genus.

ORDER TRICHOPTERA.

FAMILY LEPTOCERIDAE.

NOTANATOLICA MAGNA Walk.

One male, one female. A very common species, whose larva lives in still waters in a case made of twigs, bits of leaves, or débris.

OBSERVATIONS ON ABORIGINES OF THE FLINDERS RANGES, AND RECORDS OF ROCK CARVINGS AND PAINTINGS

BY HERBERT M. HALE AND NORMAN B. TINDALE, SOUTH AUSTRALIAN MUSEUM

Summary

In furtherance of a recent decision of the Board of Governors of this Museum, that endeavours should be made to more systematically study the fauna of South Australia, we made the observations and collections concerning which this paper forms a first contribution; it deals more particularly with notes connected with the natives of the district investigated.

OBSERVATIONS ON ABORIGINES OF THE FLINDERS RANGES, AND RECORDS OF ROCK CARVINGS AND PAINTINGS.

By HERBERT M. HALE AND NORMAN B. TINDALE,
South Australian Museum.

Plates ii-v and text figs. 18-22.

In furtherance of a recent decision of the Board of Governors of this Museum, that endeavours should be made to more systematically study the fauna of South Australia, we made the observations and collections concerning which this paper forms a first contribution; it deals more particularly with notes connected with the natives of the district investigated.

We spent the greater part of November and December, 1924, in the Northern Flinders Ranges. Leaving the railway at Copley, formerly known as Leigh's Creek, we journeyed to Mount Serle, until recently the Government camel station, and after working here for some days, moved on to Owieandana, at the foot of the Gammon Range, and there camped for a month. Aborigines were encamped in the vicinity, and we had many interesting conversations with the older natives. The younger generation evince little or no interest in the customs and handiwork of their ancestors, and, indeed, know very little concerning them. Even the older aborigines have been in more or less intermittent contact with the white man all their lives, and only meagre details of the old-time customs of their tribe may be gleaned from them. The language also is rapidly falling into disuse; some of the full-blooded young men do not know the aboriginal names of common animals around them, and it is probable that in the course of a few years the death of the natives of the former generation will mean the severing of the last feeble link with the past life of this tribe. We therefore place on record the notes we were able to make.

WAILPI TRIBE.

The territory of the Wailpi tribe at one time extended from Nerniyankanina to Blinman (the native name of which is Anguriehina), and included part of the eastern slope of the ranges almost to Lake Frome. The members of the tribe speak of themselves as Anyimatana, a designation meaning literally hill-people, but the tribal name, Wailpi, has a value equivalent to that of neighbouring tribes, details of the distribution of which were supplied by old men of the former tribe. Thus, the north and east sides of Lake Torrens were once occupied

by the Kuyani tribe, which was divided into two local groups; one of these groups was known as the Warta-Kuyani (or plains country, Kuyani), and the natives so titled lived along the borders of Lake Torrens, and in the country near the foot of the main range; the other section of the tribe inhabited the foothills around Leigh's Creek and as far south as Beltana, and were known as the Ajnya-Kuyani. The Dieri tribe occupied the country around southern Lake Eyre, and the Yanduwulda, or Yantruwunta, tribe roamed from Innamincka to Murupeowie. A territory east of Lake Callabonna, between Tilcha and Yandama, was the home of the Wadikali tribe. The Flinders Ranges south of Blinman were frequented by the Parnkalla tribe, whose boundaries extended far south to Port Lincoln. Still another tribe lived on the western side of Lake Torrens. These surrounding tribes apparently always referred to the aborigines with whom we were in contact as the Wailpi people, but the last-named, as previously mentioned, usually called themselves Anyimatana. The location of these tribes is shown in the accompanying map (fig. 21). Howitt (1) briefly mentions the natives of the northern Flinders Ranges as the Mardala.

The members of the Wailpi tribe were divided into two inter-marrying classes, called 'Murudu.' Descent was traced, as in the Lake Eyre tribes, in the female line. The great majority of the aborigines of this tribe belong to one or other of two main totems, 'Yalpu' or 'Wara,' although formerly other totems, including 'Warichi,' 'Wilka,' 'Verti,' and 'Binaru,' were also represented. Each of these totems fell into one of the two primary 'murudu,' as shown in the following table:

Class I.	Class II.
Yalpu (Wombat)	Wara (Pinto, or Rabbit-bandicoot)
Warichi (Emu)	Binaru (Carpet-snake)
Wilka (Dingo)	
Verti (Witchetty Grub)	

No members of the first class could intermarry, but must select a partner from the representatives of the second class. Thus an old man now living at Mount Serle, 'Wanjulda' by name (fig. 18), is a Yalpu, and his wife is a Wara, while another old man named 'Munaya,' or 'Widulda,' in the same locality is a Wara and his wife is a Yalpu. Most of the old women remaining in the camp at Mount Serle are 'Wara,' and therefore it would not be correct for Munaya to marry any of them, whereas Wanjulda would not be restricted from doing so. These two old men complained that in recent years marriage rules had become very decadent, citing cases where younger natives had disregarded the restrictions, and had, indeed, forgotten even the name of their totem. The remnants

(1) Howitt, Native tribes of south-east Australia, 1904, p. 47.

of the tribe are fine types, well proportioned, sturdy, intelligent, and independent.

Munaya stated that his mother's father, Windawapala, witnessed the advent of the first white man to the Wailpi territory. The story, as often told to Munaya by his grandparents, is here set out as related. Windawapala was one day engaged in hunting for opossums in the bed of the Frome Creek, at a place about half a mile north of the present Mount Serle Station. He had ascended a gum tree, when some white men and horses appeared, and stayed for some time in the vicinity. One of the white men led the horses into the creek bed, and, seeing the native in the tree, called out to him, and then placed some tobacco, flour, and

Fig. 18. Wanjulda, an old man of the Wailpi tribe.

so on beneath the tree. Windawapala was afraid to leave the tree until the white men had gone out of sight, when he descended, and examined the gifts, but, not knowing their use, threw them away. Later he followed the tracks of the strangers to a place called Manji-yunjuru (a low hill north of and quite close to Mount Serle), and here found evidences of another stopping-place. This he avoided, and fled east to where others of his tribe were encamped.

On August 27, 1840, E. J. Eyre visited this locality, and named Mount Serle and the Frome Creek [2].

The Wailpi natives saw camels for the first time at Moro Springs, when Munaya was a small boy; the aborigines watched the strange animals file past from the top of a hill. Later, when they crossed the tracks of the camels, the old men compelled the women to bury the dung of the beasts, and smoky fires were lit to obliterate the unusual smell.

The fighting weapons of the tribe were principally in the form of missiles. Amongst these were javelins or spears ('wadlata'), throwing clubs ('bera' and 'wiri'), and non-returning boomerangs ('wadna'). The throwing club known

(2) Eyre, Journ. of Exped. into Central Aust., i, 1845, p. 117.

as hera consisted of a long shaft with a clubbed extremity, while that termed wiri was flat, knobbed at one end, and either straight or boomerang shaped as regards the shaft; both types were thrown with a swinging motion. The 'aya,' a long and very slender stick, terminating in a rather heavy, fusiform head, and similar to those sometimes labelled 'play-sticks' in museum collections, was also thrown, usually in play, but sometimes in serious fighting; another stick, called 'midla,' was necessary to effectively throw this type of club. The aya travelled a distance of thirty to forty yards, the flight being sinuous, thus making the weapon difficult to avoid. All of these clubs were parried with a yam-stick ('mungu wiri'), made of selected mallee wood, very tough, and not liable to break when struck. Stone implements ('yudla') were obtained from a quartzite mine at Murupeowie, to which excursions were made from time to time.

Where water is scarce, roots of shrubs, such as the needle-bush *(Hakea leucoptera)*, the native name of which is 'barna,' are dug out, and water is drained from them. Also, and especially during visits to the sandhill country near Murupeowie, an aestivating sandhill frog is dug up in emergencies and robbed of its contained water.

Owieandana has been used as a camping site for a very long time; indeed, this locality is one of the most important stopping-places of the Wailpi people, for here is a small, permanent waterhole or well, which, to the knowledge of the natives, always yields a constant supply of water. All around are evidences of former camps, rotten frameworks of wurlies and broken pounding stones, left by the nomads as they moved to fresh hunting grounds. Their food, in this locality at least, consisted principally of acacia seed, opossums, wallabies, lizards, particularly the Goana *(Varanus gouldii)*, and the Shingle-back *(Trachysaurus rugosus)*, and Carpet-snakes *(Python spilotes)*. The acacia seed was ground between a pounding stone, known as 'mara,' and a larger flat stone ('wera'), which is often referred to in museums as a 'nardoo' stone, although the nardoo *(Marsilea quadrifolia)* is only one of the many foods which is reduced to flour thereon. The roots of a geranium *(Erodium cygnorum)* known as 'ajinarupo' were eaten, as were also portions of another species called 'windu' *(Geranium pilosum)*. Wallabies were captured in a net closed by a running noose. The twine for the nets was made from the strong fibres of an endemic *Hibiscus (H. huegelii)*. The fibres were obtained by macerating the stems in water, and thus separating the softer material, or, if water were scarce, by burying the wood until the flimsier tissues rotted away. This type of net is still manufactured, but European string is usually used. Wallabies, and indeed all native mammals, are now exceedingly scarce at Owieandana. The large gums bear scars where food-vessels have been cut out (pl. ii, fig. 1), and where the bark has been flaked off in search of witchetty grubs. The aborigines recognize three kinds of edible

larvae under this name. The caterpillars of a large moth (*Xyleutes*) are found in the roots of the red gum, while larvae of different species of longicorn beetles bore into the sapwood of the main trunk within six feet or so of the ground level, and in the upper branches. Those occurring in the high boughs are pink in colour.

MALKAIA ROCK PAINTINGS.

At Malkaia, about six miles south-east from Mount Serle, is an ancient rock shelter. This one-time camping site of the aborigines is situated on a rock shelf fifteen feet or so above the bed of a narrow western tributary of the North McKinley Creek, in which the Malkaia Springs are located. The shelter consists of a cliff which overhangs the shelf and towers above in an almost perpendicular face for about thirty feet (pl. ii, fig. 2). The retreat is in the cliff forming the northern side of the ravine through which the tributary creek runs, and is quite a short distance from the more or less permanent springs. The actual floor area of the excavation is that of a moderate-sized room; buried in the debris of the floor were a few flint chippings (such as are used for carving patterns on wooden weapons), together with broken bones of wallabies and other animals. At the western side of the shelter is a natural alcove, and it is evident that here the natives built their fires, for the wall above is much blackened with smoke. Almost the whole of the remaining "wall space," to at least as high as a tall man can reach, is covered with paintings in pipe-clay, charcoal, and red and yellow ochre. At the time of our visit there was on the floor of the shelter a stone, flat on both sides, evidently used for grinding or pounding colours, for still adhering to it were traces of ochre. Many of the patterns intagliated in the rocks at Owieandana and other localities, as well as other designs, are here reproduced in colour. The artists possibly applied the pigments without special tools, for the lines have the appearance of having been smeared on with a finger dipped in the colour desired, the latter having been mixed into a paste with water.

Pl. ii, fig. 3, shows the paintings occupying a very uneven part of the rock-surface at the north-western portion of the shelter, near the fireplace. Figs. 1 and 2 on pl. iii are photographs of the back of the cave; the design near the lower right-hand corner of fig. 1 is shown separately on pl. ii, fig. 4. This drawing is about eighteen inches in length, and consists of a perpendicular white stripe, on each side of which spring alternate white and yellow branches. In these photographs the markings in white pipe-clay only are conspicuous, for the red, yellow, and black pigments used for many of the patterns show no contrast to the sombre rock when reproduced in half-tone. We copied most of the designs, and two accompanying text figures (figs. 19, 20) represent freehand sketches of some of them. A bird track in red, with two additional digits in black, may

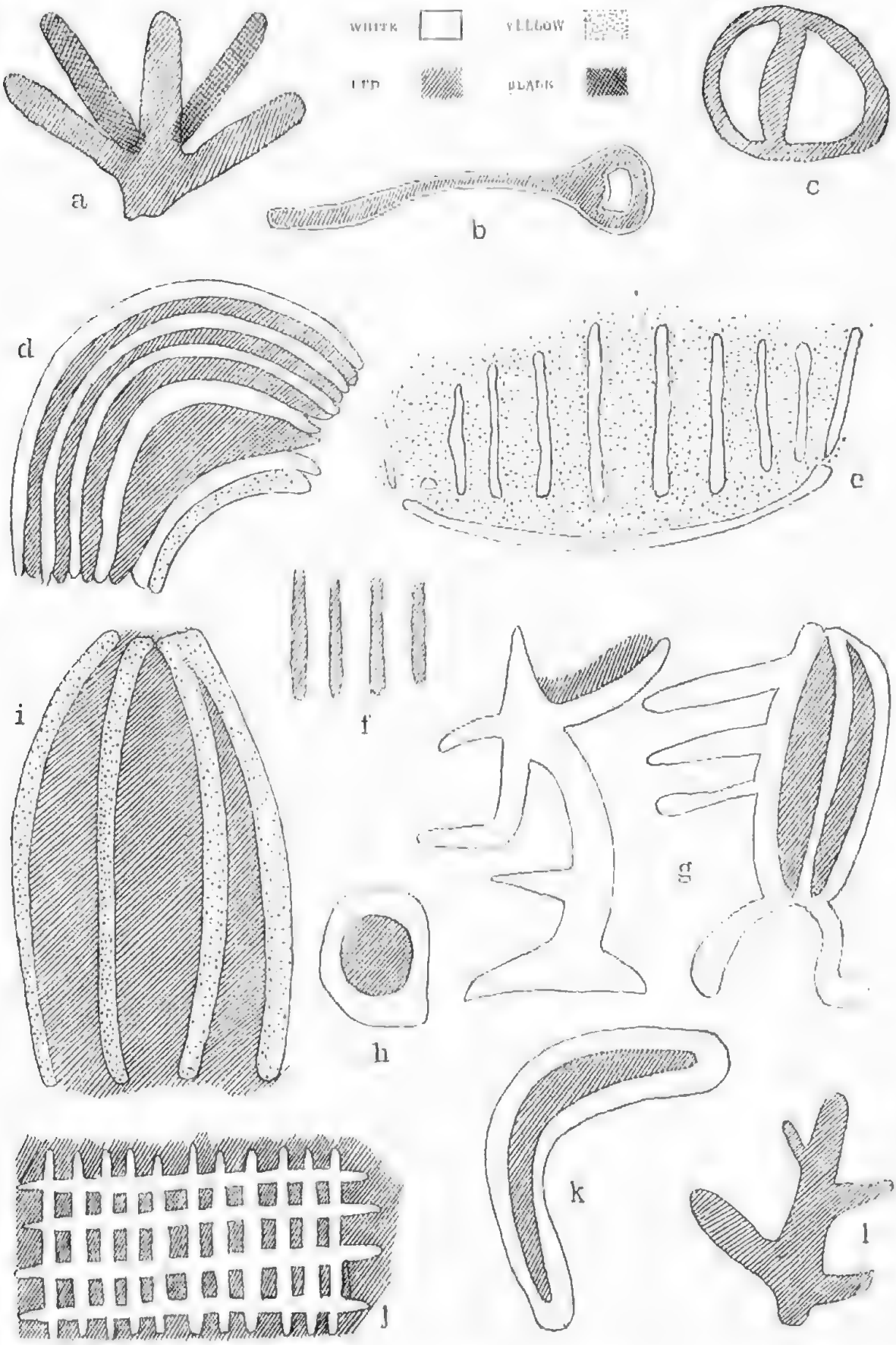


Fig. 10. Rock paintings at Malkaja approximately one fifth natural size.

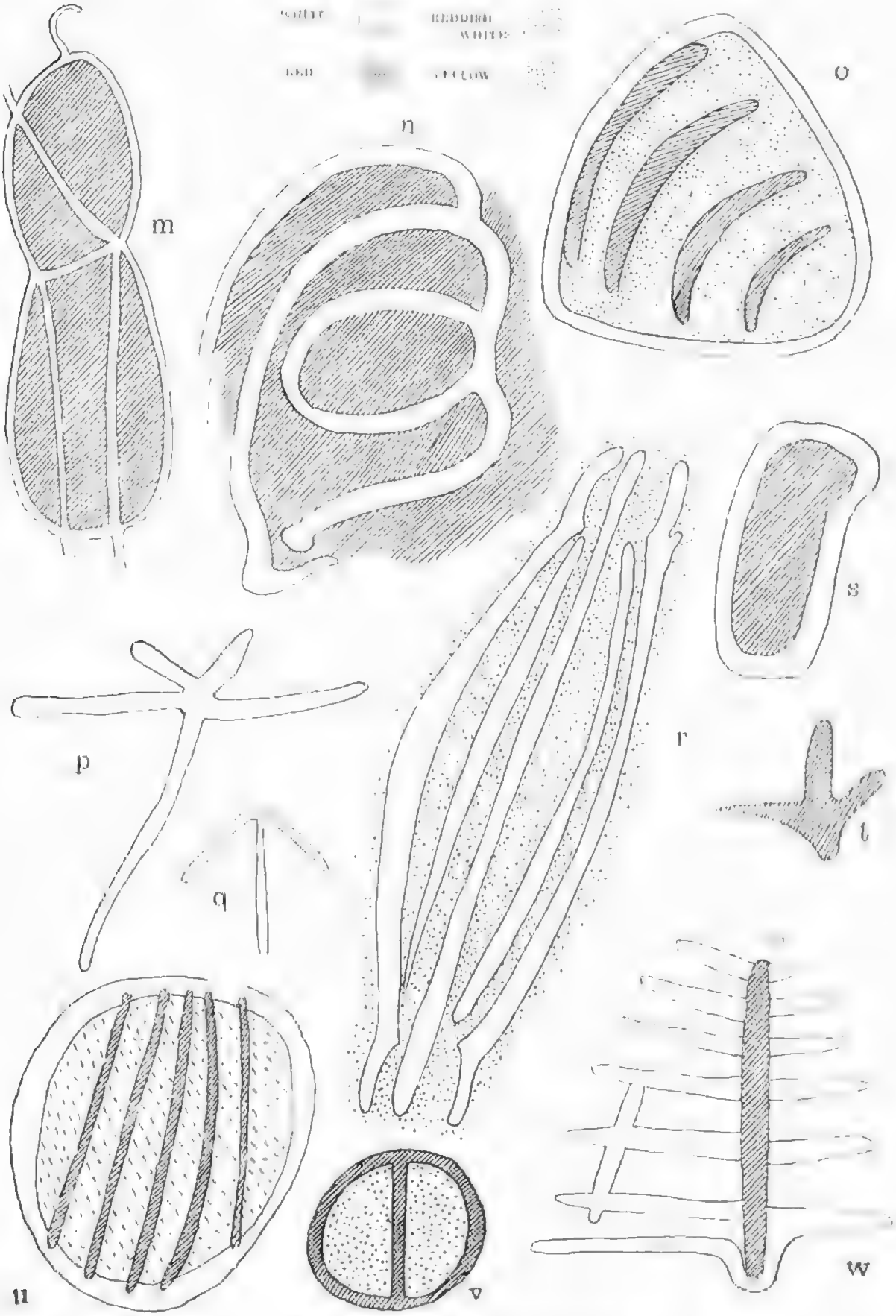


Fig. 20. Rock paintings at Mulk [illegible] natural size.

be recognized at *a*; *c*, *u*, and *v* are barred circles, and *h* and *s* circular patterns in white and red. Perpendicular bars similar to those at *f* are executed in various colours, and may be crossed by horizontal stripes, as at *j*; *k* is obviously a representation of a boomerang, and *d* and *o* are amplifications of this design. The two curious figures at *g* are in juxtaposition, as shown in the sketch. The design (*e*), consisting of a sub-horizontal curved bar, above which are some perpendicular bars, is similar to patterns referred to by Basedow, as representing pubic tassels, etc.; in another painting of this same design the horizontal bar is about two feet long and the perpendicular strokes are but two inches, or less, in length. This and certain other designs are repeated in different localities, both as carvings and paintings, so consistently that it seems certain that some definite significance was attached to each type of diagram. A meandering pattern at *n* apparently represents a snake, and *q* is a rather slender bird track; the motifs of the remaining drawings are matters for conjecture.

ROCK CARVINGS.

In 1907 Basedow noted, and in 1914 (3) described and illustrated seven separate occurrences of rock carvings in South Australia, which, he remarks, represent a "unique type of aboriginal art"; he also mentioned that he had been informed of three other localities in the northern part of our State, and one in New South Wales, where these carvings have been seen. A set of carvings on a vertical rock-face at Oratunga, in the Mooloolo district, is recorded by him, but another similar rock in the same locality, which is also inscribed with a few designs, is not mentioned.

Similar carvings to those described by Basedow were examined by Mr. E. G. Waterhouse, at Mannahill, in South Australia, on May 14, 1902. He removed part of one carving a fortnight later, and forwarded the fragment to J. G. O. Tepper (then Entomologist at the South Australian Museum), together with the following descriptive letter:

"I am sending . . . part of a native tattoo of a kangaroo's track, which I obtained whilst on my leave at near Mannahill, where I know of numerous tattoos or rock carving of the natives, some of which are very well done. On the 14th inst. I tried to get some of them off the rocks, but . . . had to give it up, as the rock was very hard and brittle; . . . the specimen . . . is about three-quarter track of the right part of the right foot of a kangaroo.

"Some of the tracks are so nicely tattooed on the rocks that it is quite easy to distinguish the difference between the kangaroo, euro, and wallaby . . .

"In some places you can see what is apparently meant for a waterhole tattooed on the rocks, and tracks of animals and birds going away in a certain

(3) Basedow, Journ. Roy. Anthrop. Inst., xliv, 1914, pp. 195-214, pl. i-xvii.

direction to feed, and in other places where they are going to a waterhole to drink.

"On some parts of the Oultalpa run there are large mounds of stones built by the native, but for what reason up to now I have not been able to ascertain.

"I should like very much sometime to photograph some of these objects, and it is my intention when I get my next annual leave to do so, also to saw some of these carvings off."

In reference to this discovery the following note appears in the Proceedings of the Royal Society of South Australia (4) for June of the same year: "Mr. J. G. O. Tepper, F.L.S., exhibited a piece of limestone from Mannahill, forwarded by Mounted-Constable Waterhouse, of Crystal Brook, who supposed the markings on it to have been done by aborigines. Mr. Tepper explained that these were due to the action of certain algae and lichens. The Secretary was instructed to write to Mr. Waterhouse and ask him to protect any native etchings he might any time know of from being disfigured."

Owing to this misidentification, nothing further has been written concerning these Mannahill carvings, the first examples of this type of native art to be noted. The specimen and letter from Mr. Waterhouse are preserved in the South Australian Museum.

During a recent trip to the Northern Territory, one of us learned that at Mungajera, a mountain near the mouth of the Roper River, there is a leaning rock-face, in the surface of which emu-tracks, conventional human figures, and hands have been cut. These appear to be of great age, having been smoothed by the passage of time. The people of the coastal section of the Mara tribe do not remember how or when these carvings were made.

At Owieandana a number of outcrops of sedimentary rock, situate on low rises within one or two hundred yards of the aforementioned waterhole, and a few rock-faces in the bed of the Gammon Creek, are inscribed with carvings, so that this locality is also to be added to those already listed. The accompanying map (fig. 21) indicates all known sites of these carvings in South Australia, with the exception of Mallett, which is not included. It seems probable, from information we gathered from bushmen, that others will be recorded when the aboriginal camping places are more thoroughly explored. Carvings north and south of Owieandana have been already described, but those at this locality have escaped previous notice. The Owieandana carvings occur upon clay slate, a similar rock to that upon which carvings are made at Mannahill and Oratunga. Similarly, the surface of surrounding rock and carvings alike are covered with a hard, "dark, rust-coloured 'patina,' or glazed surface-film. · · · The strongest geological evidence in support of great antiquity." By digging at the bases of

(4) Trans. Roy. Soc., S. Aust., xxvi, 1902, p. 326.

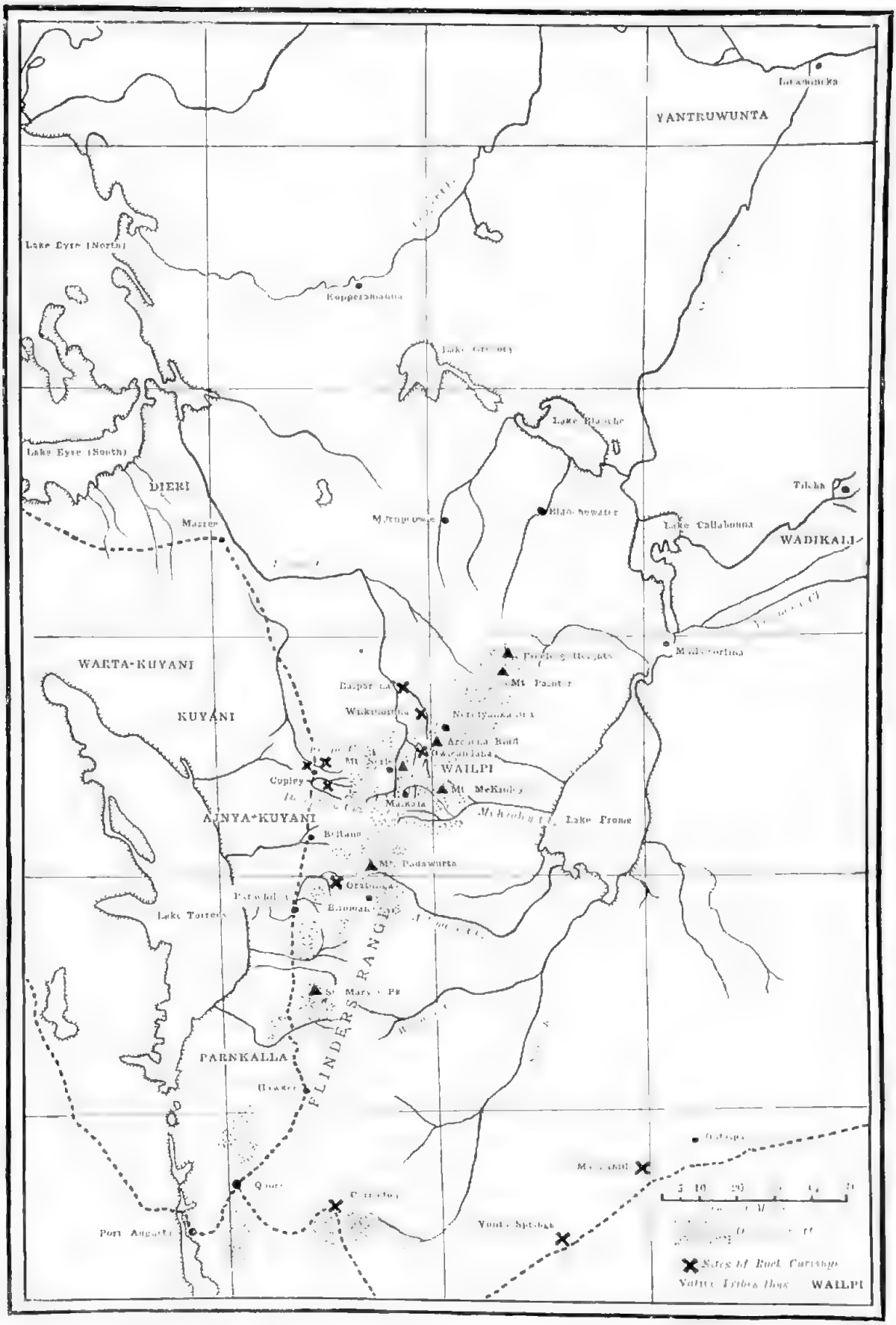


Fig. 21. Map showing distribution of tribes of northern Flinders Ranges, and sites of rock carvings.

some of the outcrops at Owieandana, carvings partially or wholly buried were exposed, some of them being nine inches below the present ground level.

Basedow found that "The living generation of blacks in the Flinders Ranges know nothing about the carved productions of art here discussed." We also found this to be so, for several old men, on being questioned, remarked that when they were boys their fathers made the carvings with the sharpened end of a horseshoe. A few of the designs have not the technique of the majority. Circles, for instance, are in most cases formed of a great number of closely connected indentations, possibly made with the sharp point of a hard stone chisel. A few of the patterns, however, consist of a circular series of straight indentations (such as might be made with the edge of a cold-chisel), each cut disconnected, and obviously not executed with the skill and precision of the others; a portion of one of such circles is shown on the left edge of one of the photographs (pl. iii, fig. 3). These are in all probability those referred to by the old men, and evidently represent comparatively recent, sporadic attempts to copy the ancestral work, without knowledge of its original significance.

Fig. 22. Tracings of rock carvings at Owieandana (one-fourth natural size).

Taken as a whole, the carvings are perhaps not so interesting as some of those previously recorded. In the main they consist of "corrobborree-circles" some a mere outline, some with a bar across, others sparsely stippled with indentations in the enclosed area—incomplete circles, some spiral designs, a few emu and other tracks, and some unidentified patterns. The few circles on perpendicular rock faces in the bed of the Gammon Creek are much larger than those on the higher ground, which are carved on sub-horizontal surfaces.

Photographs of a few sections of the Owieandana carvings are reproduced on pl. iii and iv. As our camera was a small one, the intaglios were "rubbed in" with pipe-clay before they were photographed, so as to more plainly define the patterns. The illustrations on pl. iii, fig. 3, and on pl. iv, figs. 1 and 2, represent some of the small outcrops of slate upon which the carvings occur. Closer views of a few of the designs are shown on pl. iii, fig. 1, and on pl. iv, fig. 3, and tracings of six patterns appear in text fig. 22.

In places portions of the rock faces, two inches or more in thickness, have been separated from the main mass of the slate by the action of the weather; the two pictures on pl. iv, figs. 3, 4, show this disintegration clearly. A few carvings were found on small sections thus fractured; these examples were comparatively easily removed, and were brought to Adelaide for the Museum collection. A natural-size photograph of two conjoined circles engraved on one of these fragments shows the character of the chippings forming the design (pl. v). By a familiar illusion the sculpturing will, to many, appear to be raised instead of cut into the rock.

Basedow notes the great differences between these Flinders Range carvings and those scratched or cut into the Triassic sandstone at Port Jackson. Some years ago, one of us inspected some designs scratched by natives of the lower Murray River district in the back of a small cave at Wongulla. The designs were cut into the soft Eocene sandstone of the cliff with a sharp stone instrument, and in no way resemble the technique of the northern carvings (pl. iv, fig. 4).

The aforementioned author illustrates a design occurring on rocks at Deception Creek, "strongly suggestive of a platypus," and remarks that there is reason for supposing that this animal has been observed in Dalhousie Springs. "The description given by natives of some animal seen by them in the springs, and the corroborative evidence by a reliable bushman, are responsible for this belief . . . ." It may be of some little interest to here note that we also met a bushman who, on his own initiative, and without previous discussion on the subject, informed us that he had recently seen a platypus in the interior.

LANGUAGE.

The old Wailpi natives say that many of their grandparents and fathers were able to speak more than their own tribal language, but that they themselves know only the one dialect. Long ago the oldest men of the tribe could converse amongst themselves in a manner which the younger natives could not understand. As previously mentioned, the young men of to-day are gradually forgetting their tribal language.

The natives have a distinguishing name for every physiographical feature of their territory, no matter how apparently unimportant the feature may be.

Thus Mount Serle as a whole is known as 'Artu warapana,' the western face of the hill is called 'Nalimati,' and the northern saddle 'Wokara,' while the lower foothill to the north of the mount is named 'Manji yunjuru.' Many animals have more than one name, but, on the other hand, several closely allied species may bear a common name, as, for instance, two species of Babblers (*Pomatostomus*), which are not differentiated, both being termed 'inyula.' It may at first glance seem curious that there should be in an arid northern area an aboriginal term ('wula') for snow. Some of the natives, however, have seen snow on Mount Padawurta (formerly known as Mount Rugged), in the Mooloolo district, on several occasions. The Wailpi people call this mountain 'Verti warta,' and 'Padawurta' is obviously a corruption of this name.

The hand is referred to as 'mara,' and this term is also applied to the pounding or smaller mill stone, which is grasped in the hand for grinding food.

PART VOCABULARY OF WAILPI TRIBE.

Mammals.

Dingo or wild dog	wilka
Euro (*Macropus robustus*)	manja
Pinto	wara
Red Kangaroo (*Macropus rufus*)	wudlu
Rock Wallaby (*Petrogale xanthopus*)	andu
Wombat (*Phascolomys*)	yalpu

Birds.

Australian Bustard (*Eupodotis australis*)	wal'la
Australian Pipit (*Anthus australis*)	yaliworuna
Bare-eyed Cockatoo (*Cacatua gymnopis*)	warandu
Bird (general name for small bird)	yuta
Black-backed Magpie (*Gymnorhina tibicen*)	wurukuli
Chestnut-crowned Babbler (*Pomatostomus ruficeps*)	inyula
Chestnut-eared Finch (*Taeniopygia castanotis*) ..	ithi (th as in 'the')
Crested Pigeon (*Ocyphaps lophotes*)	murambara
Crow (*Corvus*)	wakla
Emu (*Dromaius novae-hollandiae*)	wariehi
Grey Butcher-bird (*Cracticus torquatus*)	andipi
Grey Shrike-thrush (*Colluricincla harmonica*) ..	anda anda
Masked Wood-swallow (*Artamus personatus*) ..	ralpula
Peaceful Dove (*Geopelia placida*)	kurukuku
Purple-backed Wren (*Malurus assimilis*)	yuruyuruya
Red-capped Robin (*Petroica goodenovii*)	malitelita
Red-backed Parrot (*Psephotus haematonotus*) ..	bard'laru

Tree Martin *(Hylochelidon nigricans)*	yukowokoni or wireldutulduti
Wedge-tailed Eagle *(Uroaetus audax)*	wildu
White-browed Babbler *(Pomatostomus superciliosus)*	inyula
Yellow-throated Miner *(Myzantha flavigula)*	madlaei'tana

Reptiles and Batrachians.

Banded Skink *(Hinulia fasciolatum)*	appara
Carpet-snake *(Python spilotes*, var. *variegatus)* ..	binaru
Frog, sandhill species, large	yalja
Frog, Waterhole	ngar'na
Gecko *(Gymnodactylus miliusii)*	aljen'nara
Gecko *(Peropus variegatus)*	mun'ka
Goana *(Varanus gouldii)*	radna
Jew-lizard *(Amphibolurus barbatus)*	kadni
Snake-eyed Lizard *(Ablepharus boutonii)* .. .	ngarupuruna
Stump-tailed Lizard *(Trachysaurus rugosus)* .	mudlu or ardnu
Woma-snake *(Aspidites ramsayi)*	wabma

Insects, etc.

Ant, bulldog *(Myrmecia forficata)*	aldu
Ant, urine *(Iridomyrmex)*	wipa or ngari
Butterfly, white *(Delias aganippe)*	arlevilivili
Centipede (any)	wange jeri
Cicada	waldamburri
Dragon-fly (any)	witu witu
Fly	yapu
Grasshopper (any)	wichirika
Hawk-moth *(Deilephila livornica)*	wulga
Mantis *(Thorodia melanoptera)*	wulangara
Witchetty grub	verti

Plants.

Black-oak *(Casuarina lepidophloia)*	ailko
Box-mallee *(Eucalyptus sp.)*	yunda
Buckbush	yilka
Bullock-bush *(Heterodendron oleifolium)* ..	minyara
Geranium (edible) *(Erodium cygnorum)* .. .	ajinarupo
Geranium (edible) *(Geranium pilosum)* ..	windu
Nardoo *(Marsilea quadrifolia)*	ara
Needle-bush *(Hakea leucoptera)* .. .	barna
Peach, native *(Fusanus spicatus)* .. .	wulti
Pine *(Callitris robusta)*	binba

Red-gum *(Eucalyptus rostrata)*	wera
Sandalwood *(Myoporum platycarpum)*	emburu
Tea-tree *(Leptospermum scoparium)*	ora
Wattle *(Acacia sp.)*	nguri

Utensils and Weapons.

Boomerang	wadna
Club, boomerang type	wiri
Dish made from red-gum bark	beki or wichi
Grinding stone (small pounding stone)	mara
Grinding stone (large flat stone)	wadla
Play-stick	aya
Spear	wadlata
Stick for throwing play-stick	midla
Stone implement (knife or spear-head)	yudla
Yam-stick	mungu-wiri

Physical Features.

Cave, or rock shelter	itapi
Clouds	wulpi
Creek	veri
Fire	ardla
Frost	arrata
Moon	vera
Mountain summit	manbata
Rainbow	wuranyi
Rock of large size	miri
Snow	wula
Stars	buudli
Sun	yuundu
Water or rain	awi

Numerals.

One	unmorta
Two	aipilana
Three	wulparina
Five (literally 'one hand')	unmorta mara
Ten (literally 'two hands')	aipilana muruku

General.

Baby (either sex)	yakati
Hand	mara
Hands	muruku
Man, old	wulka

Man, young	yangari
Penis	wariardlu
Vulva	indi
Woman, old	wilkuta
Woman, young	artu
Woman	adni
Blood	arti
Meat	ba lu
Come here!	avia
Come quickly!	avi yavu yavu
Fight	laicha
Kill (literally to 'strike dead')	undaka wudnyu
Little	widna
No	madla
No good	widni
Steal	werdli
Strike	undaka
What is it?	nangatana?
Yes	ngaku

EXPLANATION OF PLATES.

Plate ii.

Fig. 1. Red Gum from which a food-vessel has been cut.

Fig. 2. Rock-shelter at Malkaia.

Figs. 3, 4. Rock paintings at Malkaia.

Plate iii.

Figs. 1, 2. Rock paintings at Malkaia.

Figs. 3, 4. Rock carvings at Owieandana.

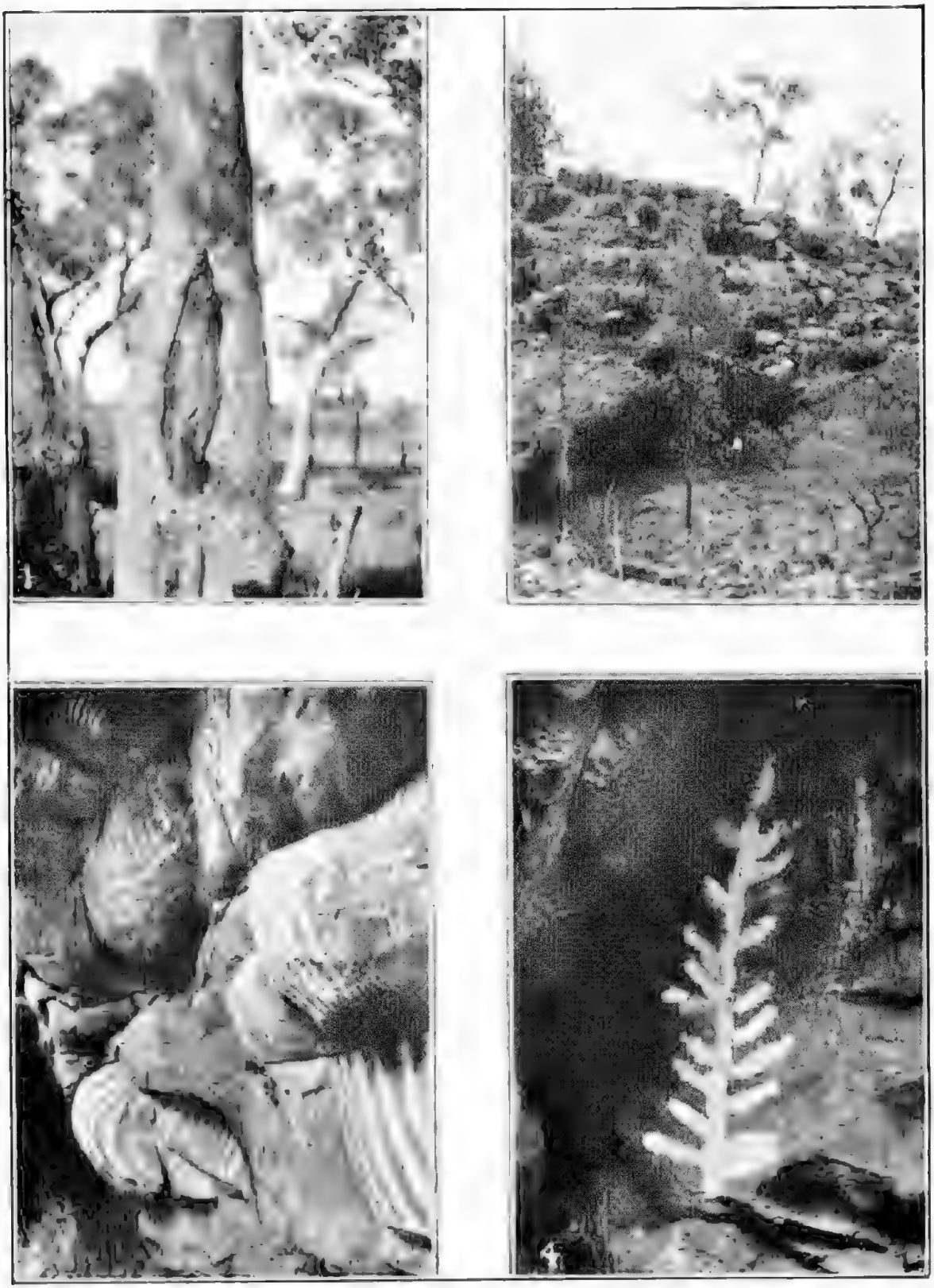
Plate iv.

Figs. 1-3. Rock Carvings at Owieandana.

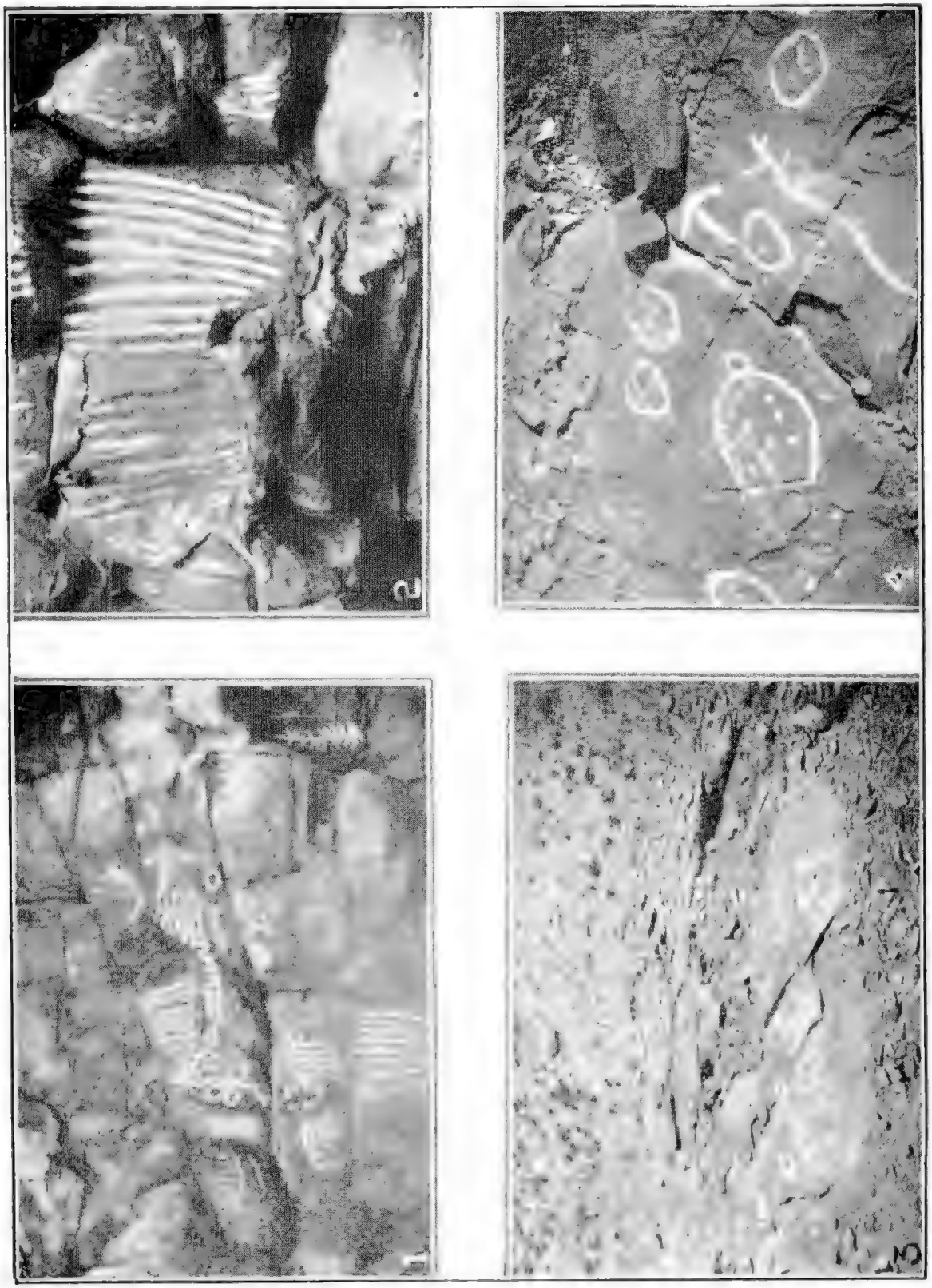
Fig. 4. Rock carvings at Wongulla, River Murray (for comparison).

Plate v.

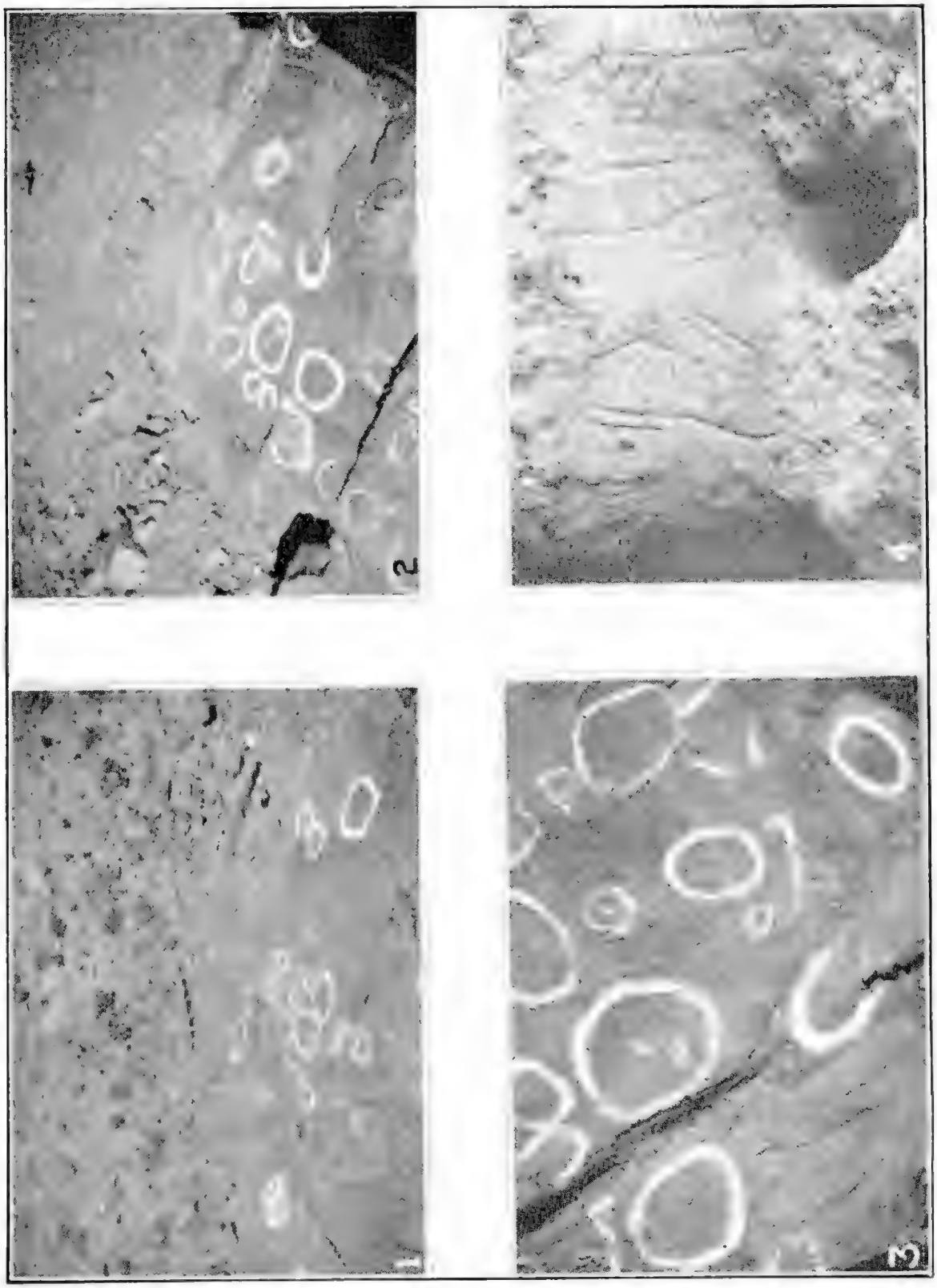
Rock carving from Owieandana, natural size.



NATIVE PAINTINGS, ETC.



NATIVE PAINTINGS AND CARVINGS.



NATIVE CARVINGS.

NATIVE CARVINGS.

NATIVES OF GROOTE EYLANDT AND OF THE WEST COAST OF THE GULF OF CARPENTARIA

BY NORMAN B. TINDALE, ASSISTANT ENTOMOLOGIST, SOUTH AUSTRALIAN MUSEUM

Summary

During the years 1921-22 I spent some fifteen months on and around Groote Eylandt and in the Roper River District, paying special attention to entomology. The natives, several tribes of which have hitherto remained practically untouched by European influences, presented opportunities for study, and the following paper constitutes a record of observations made. At least six of the tribes mentioned have not previously been definitely noted in literature.

NATIVES OF GROOTE EYLANDT AND OF THE WEST COAST OF THE GULF OF CARPENTARIA.

By NORMAN B. TINDALE, Assistant Entomologist, South Australian Museum.

Plates vi-xi and text figs. 23-41.

During the years 1921-22 I spent some fifteen months on and around Groote Eylandt and in the Roper River District, paying special attention to entomology. The natives, several tribes of which have hitherto remained practically untouched by European influences, presented opportunities for study, and the following paper constitutes a record of observations made. At least six of the tribes mentioned have not previously been definitely noted in literature.

Through the courtesy of the Rev. H. E. Warren I was associated with him during the examination of the islands of the Groote Eylandt Archipelago (June to September, 1921, and April, 1922) in the auxiliary ketch "Holly," for the purpose of choosing a site for a mission station. I am indebted to Mr. A. J. Dyer, of the Church Missionary Society, my companion during the stay on the island (November, 1921, to April, 1922), who provided numerous notes on the language and customs of the Nungubuyu people, and to Mrs. Dyer, who subsequently furnished several notes on the Ingura women. By the kindness of the Rev. R. D. Joynt and Mr. T. Bridgland (police constable at Leichhardt Bar), I was enabled to make an examination of a cave at Wagundu, a native camping site in the country south of the Roper River.

Some of the observations herein recorded were first made public in an illustrated lecture given by me in Adelaide on August 21, 1923. In this connection it is interesting to find that remarks made on the women and sailing canoes of Groote Eylandt were deemed of sufficient importance by Dr. Herbert Basedow (1) (who was present at the lecture) for publication in his latest work, during the current year.

The early Dutch explorers visited the Gulf of Carpentaria, but have left little record of their doings. The first detailed description of the country was given by Flinders (2) in his narrative of the circumnavigation of Australia. He charted the coast (his charts with a few alterations are in use to-day), sailed around Groote Eylandt, landed on the adjacent islands in Blue Mud Bay, where he had an encounter with the natives, in which two were killed, and, during a

(1) Basedow, The Australian Aboriginal, 1925.
(2) Flinders, M., Voyage to Terra Australis, ii, 1814, p. 177 *et seq.*

brief stay at Caledon Bay, made a few observations on the natives, and compiled a vocabulary of the language of a tribe, now known to be the Balanumu.

Ever since the building of the Overland Telegraph, when steamers first ascended the Roper River with supplies, vessels have at various times passed along the coast on the way from Darwin to Borroloola and Leichhardt Bar, but owing to the reputation which the natives had, not without justification, for treachery, very little communication was held with them. Warren (3), in his account of his first trip around Groote Eylandt, refers to the natives of Rose River (Nungubuyu Tribe) and to several Groote Eylandt men he met on Bickerton Island. The only other definite reference to the Groote Eylandt natives appears to be by White (4), who on a voyage to Roper River, took shelter behind the barren south-western arm of the island, where two natives came out in a canoe to his ketch.

An ornithological expedition, organized by H. L. White, made a short stay on the island during the earlier part of my sojourn there, but the only reference to the natives is given by Baldwin Spencer (5), who describes six decorated slabs found in an old camp by members of the expedition.

With the exception of the accounts referred to above, nothing has appeared concerning the eight or more tribes living in the country north of the Roper River.

WEST COAST TRIBES.

The tribes may be divided into two groups, those who live along the coast and on the islands, often called 'saltwater blacks,' and those of the inland plains, who seldom visit the coast. Starting in the north, the first coastal tribe to be mentioned is the Tchambarupi, whose country extends from about Elcho Island on the north coast of Arnhem Land, to Cape Arnhem, and includes the English Company Islands. Further south are the Balanumu, claiming the country from below Cape Arnhem to Cape Shield and the northern portion of Blue Mud Bay: their headquarters being at Caledon Bay. The low shores of Blue Mud Bay are frequented at times by a small tribe of inland natives, the Rittarungo, whose headquarters is about the headwaters of the Goyder and Walker Rivers. From south of the Walker River, in its lower reaches to the Rose River, the country belongs to a comparatively large tribe, the Nungubuyu. Groote Eylandt and the adjacent islands are inhabited by the Ingura, a small tribe, with some peculiar characteristics. South of the Rose River, between the territories of the Nungubuyu and their southern neighbours, the Mara, live the remains of a tribe,

(3) Warren, H. E., Victorian Geog. Journ., xxxiv, 1918, pp. 8-17.

(4) White, G., Thirty Years in Tropical Australia, 1918, pp. 144, 145.

(5) Spencer, Baldwin, Guide to Australian Ethnological Coll., 3rd ed., 1922, p. 102, and pl. 20.

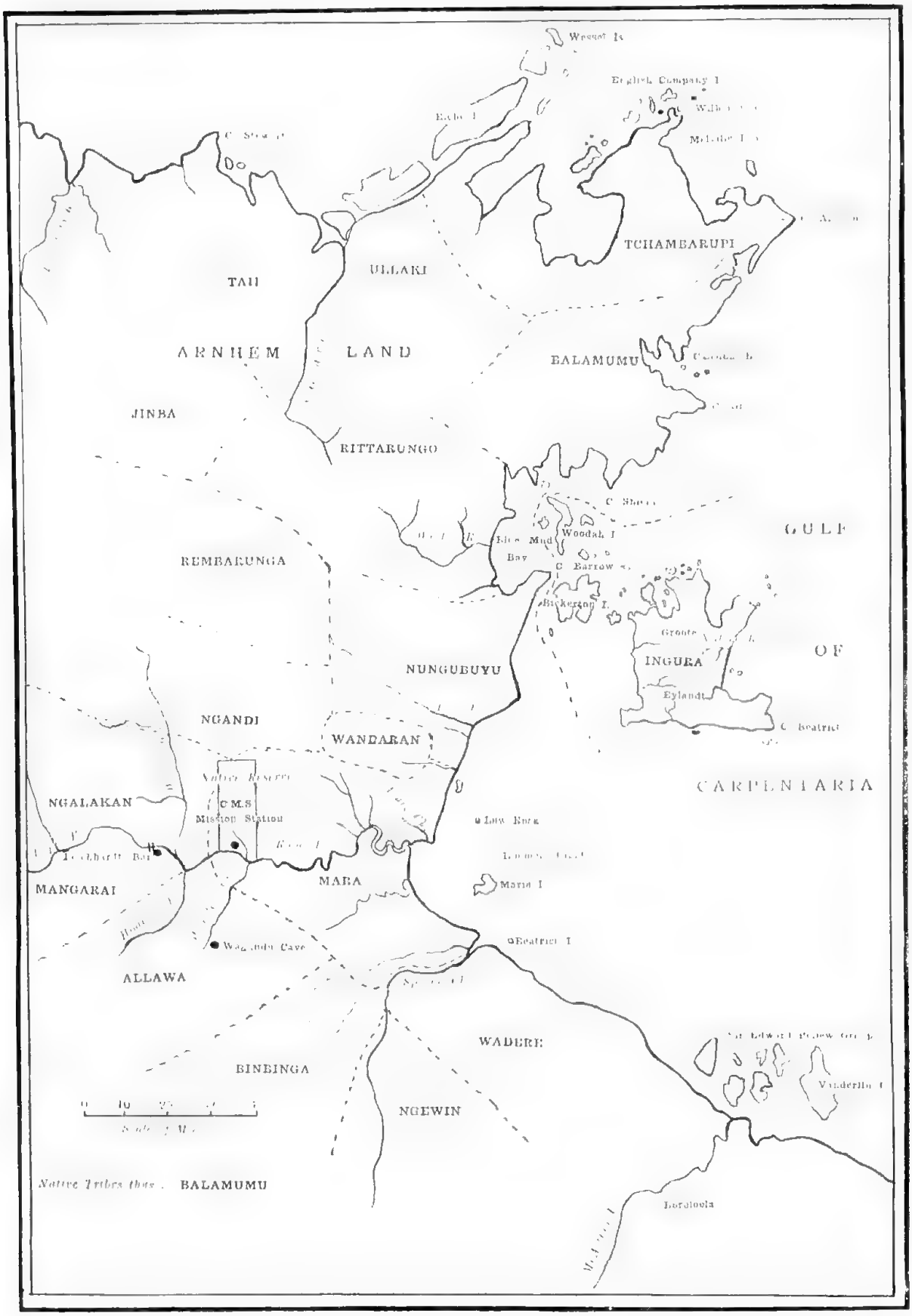


Fig. 23. Map of the West Coast of the Gulf of Carpentaria showing distribution of Tribes.

called the Wandaran, whose members are few in number, and live among their neighbours, but without more than the usual tribal communication with them. They speak a definite language of their own, but appear to be dying out from natural causes. The Mara, referred to by Baldwin Spencer ([5]) ([7]), were formerly a large tribe, but the inland sections are now becoming decadent; they range from north of the Roper River to about Spillen Creek, and extend their boundaries about forty miles inland. To the south they are in contact with the Wadere, also a coastal tribe.

Of the inland tribes the Rittarungo are the most north-easterly; further to the west they adjoin the Jinba, an inland tribe of the northern coast; to the south of the Rittarungo, about the headwaters of the Rose River, are the Rembarunga. In the country towards the sources of the Wilton River, and as far north nearly as the sources of the Rose River, are the Ngandi. On the northern bank of the Roper River, above the junction of the Wilton, are the Ngalakan, while south of the Roper, in the country drained by Mountain Creek and the Lower Hodgson River, are the Allawa. Further inland, toward the sources of the Roper River, are the Mangarai. To the south of the Allawa are other tribes, such as the Binbinga and Ngewin. These and those still further south and west are shown on the map given by Baldwin Spencer ([8]).

The sketch map (text fig. 23) gives very approximate indications of the boundaries of the tribes mentioned. They are not always well defined, near-by camping sites being regarded as more or less common property.

INGURA TRIBE.

The boundary of the Ingura tribe is coextensive with the islands of the Groote Eylandt Archipelago, comprising an area of approximately one thousand square miles, divided into one large island, three smaller ones with permanent water supplies, and many islets scattered about, mostly at the northern part of the archipelago. A liberal estimate would place the entire population at little more than three hundred, and it is split up into at least six local groups or sub-tribes; two larger and four smaller ones. Each of these is known by the name of the locality which is its headquarters; for instance, a man will say, "Naiuwa Talakurupa ambaria," "I Talakurupa sit down" (belong). The names of these groups and their location on the island are: Bartalumbu, north-west; Angoroko, west; Yetiba, south-west; Talakurupa, east and south-east; Amakurupa, north-east and Phara-phara, inhabiting the northern portion of the island (see text fig. 24).

([5]) Spencer, Baldwin, Native Tribes of the Northern Territory, 1914, p. 60 *et seq.*

([7]) Spencer, B., and Gillen, F. J., Across Australia, v. 2, 1912, p. 479 *et seq.*

([8]) Spencer, Baldwin, Native Tribes of the Northern Territory, 1914, p. 6.

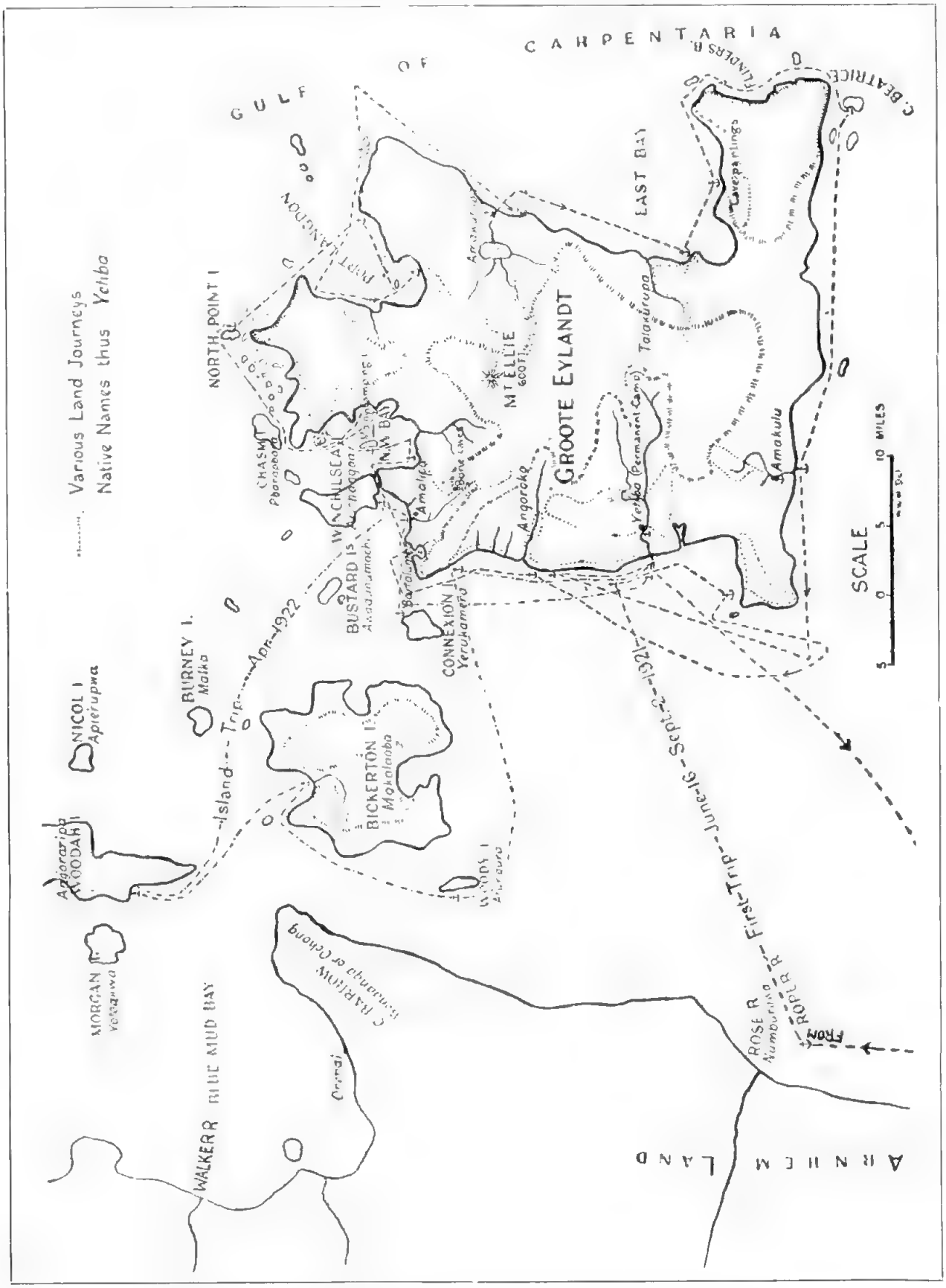


Fig. 21. Map of Groote Eylandt showing native locality names.

The Bartalumbu group occupies Bickerton Island and Batalumbu Bay. They probably number about a hundred, and with the Talakurupa comprise over two-thirds of the natives. At certain seasons they visit all the islands near the mainland, also Wendanga (Cape Barrow), where they are in communication with the Nungubuyu, whose language many of them speak. They are the chief navigators of the tribe, and are the only islanders possessing large sailing canoes. The other large group, the Talakurupa, have their home on the south-western portion of the main island; they are considered to be fierce, and are feared by the Bartalumbu, who generally retreat to Bickerton Island when they are 'nabada' (angry). Many of the finer weapons and much information were obtained from the members of this group, who came across the hills and camped at Yetiba for considerable periods during my stay there. They seldom visit the mainland or the other islands of the archipelago. The Yetiba have their head quarters at Yetiba Creek (Emerald River), and frequent the south-western part of the island as far to the east as Amakulu Creek. They are few in numbers, and appeared not to take part in the feuds carried on between the members of the two larger groups. There are also two isolated groups, probably each of only one family, the one named Angoroko, frequenting the vicinity of the creek of the same name on the west side of the island, and the other, the Amakurupa, living around the shores of Port Langdon, and Amakurupa on the north-eastern side. Pbaraphara (Chasm Island), Arichangoa (Winchilsea Island), and the Eirene Archipelago are the hunting grounds of Papatama, an old man, and his family, which includes two adult sons.

The Ingura are similar in appearance to the natives of the adjacent mainland tribes, but there is evidence to show that their contact with Macassar traders for several centuries has brought about certain modifications, and has introduced from time to time a strain of alien blood.

The Northern Territory natives have apparently always been hostile to the alien intruders who visited their coasts, and no intimate contact, except in special circumstances, ever took place. On Groote Eylandt several causes appear to have brought about closer communication with the natives than would be elsewhere possible. On each visit the Malay fleets spent much time at the island, which was apparently a rendezvous. This is also shown by their camps, the remains of which cover extensive areas on the northern part of the island. The natives were employed in shelling and trepanging, and many of the young natives were from time to time taken away on the return voyages to Macassar, often returning with extensive knowledge of the habits and appearances of the people they associated with. The presence of broken fragments of square gin bottles buried about the Malay camps indicate that liquor was in all probability given to the natives, and notwithstanding the strict measures adopted by the

natives to prevent their women falling into the hands of the Malays (which measures have developed into a permanent practice), in course of time such contact frequently took place, and numbers of the present-day natives have had aliens among their ancestors. For instance, the two boys on the left in text fig. 25, who are full-brothers, and belong to the Bartalumbu local group, are believed to have had a Malay ancestor.

The children remain with the women until they are about eleven years of age, but younger boys are seen temporarily in the men's camp. They are well cared for, and numerous toys are made for them, including model canoes and toy paperbark dishes. Wooden canoes of a size large enough to contain two or three young boys are also made, and one of them (about seven feet in length and a foot in width) is now in the Museum collection. On one occasion a child of about seven was brought up to see us by its father, but was so shy that a

Fig. 25. Boys of Bartalumbu. Fig. 26. Boys of Talakurupa.

photograph was not secured. As in many aboriginal children, one of its prominent features was a distended abdomen. Text fig. 25 shows three boys of the Bartalumbu local group, and text fig. 26 two of the Talakurupa local group, who have just passed through the first stage of initiation

The young boys are encouraged to play at spear-fighting, using diminutive throwing-sticks and lengths of cane-grass as weapons. They are often assisted and encouraged by young and middle-aged men. These games are often continued for days, frequent visits being made to the cane-grass flats for supplies of weapons. At Yeriba, after fights which occurred there, the children were assiduous in imitating their elders, and the stringybark forests on the banks of

the Yetiba were a favourite battling ground: the retreating side would often take to the water, where, yelling, splashing, dodging, and diving, the play would be continued.

Initiation Ceremonies.

The circumcisional and other initiation ceremonies are collectively called 'Unamalia-maindi.' The first takes place between the ages of ten and thirteen. At Amalipa a large circular area, with one tree near its centre, situated about five hundred yards from the Amalipa ceremonial ground, described in a later paragraph, was pointed out as the place of the ceremony, but few details were gathered as to the procedure. The operator was always an old man, and the stone head temporarily detached from a spear was the knife used for the operation.

The 'wiyideaba' (boy) is before the ceremony removed from the women's camp and placed under the guardianship of a middle-aged man, who has charge of him for several years. The lad calls his guardian 'nababo,' and is called by him 'nanigi.' After the ceremony he is kept in the men's camp, and takes his share in paddling, firewood gathering, collecting fish bait, and generally in waiting on his elder companion. One such guardian, who was a frequent visitor at Yetiba, had two boys under his care; they were never allowed out of his sight, followed him when hunting, and when in camp attended frequently to his person, combing his hair, removing lice therefrom, and sometimes red ochreing his body all over (see text fig. 28). The hole in the nose, 'anyuenya,' is bored at about the same period as the circumcision.

At about sixteen or seventeen the first cicatrix is made on the chest of the initiate. One lad underwent the ceremony at Yetiba. It was noticed that all the younger initiates were removed from the camp one evening under the care of an old man. The usual nightly performance of drone-pipe playing was kept up with exceptional vigour, with much clapping together of throwing-sticks and frequent chants (apparently wordless), sung by the old men. Nothing unusual, however, was noticed in the camp, except the lad sitting quietly apart, with his body marked with a design in pipeclay. The ceremony reached its climax at dawn, when the boy was held down on the ground while a deep cut was made by an old man with a spear-head, extending from side to side on the chest, just below the nipples. Several hours later the lad appeared smiling, and proudly exhibiting the fresh cut. Much bleeding had taken place, but pipeclay had been rubbed well into the flesh, and as blood appeared and congealed the lad carefully picked it out with a sharp-pointed stick. In a bag suspended from his neck, and hanging down his back, he carried a flat, smooth-edged piece of soft stone, with which he kept the wound open for some weeks by pressing it into or rubbing it

along the cut. He showed little sign of discomfort, and the next day was bathing in the creek with his companions. The wound gradually healed, and within three months a considerable raised scar resulted. After the ceremony the boy was allowed to share in the full life of the camp, and the guardianship of the 'nababo' lapsed. At first he was pleased with his new status, often putting his hand against his chest and saying proudly, 'wanumamalia' (young man).

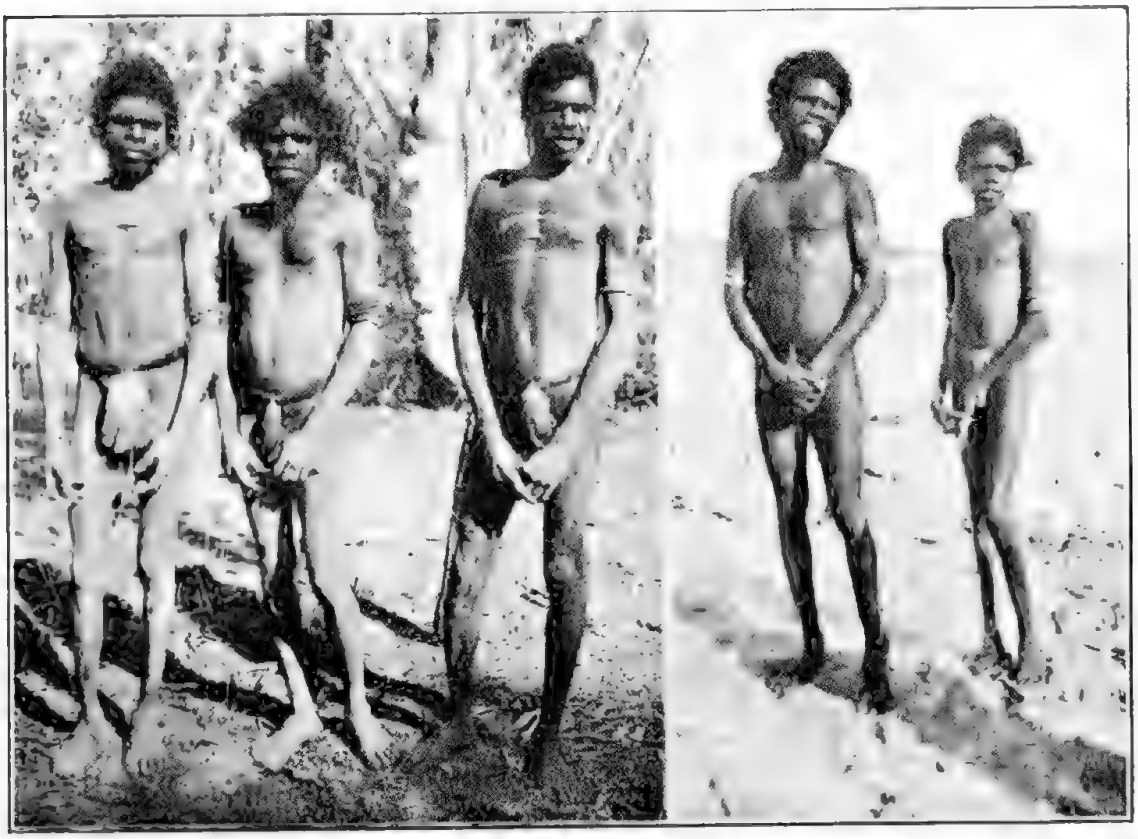


Fig. 27. Ingura men. Fig. 28. Guardian and initiate.

Among the Ingura and the Nunguhuyu the first cut is made just below the nipples, and from time to time further ones are added, usually a second below the first, and then further ones higher up on the chest. The latter are often cut very deep, and owing to the great pain are usually done in two stages, so that many natives are noticed with a cut only on one side of the chest. The full number usually consists of about six, either four above the nipples and two below, or three above and three below. Besides these cicatrices, each native generally has many short raised marks on the upper part of the left arm; these are usually made by burning the flesh with the aid of a firebrand. The Balanumu, on the mainland, however, after the first chest cut, make three longitudinal cuts on

the left arm. Among the Ngandi the common practice is to place four large cuts low down on the chest and three or more slanting cuts on the left thigh.

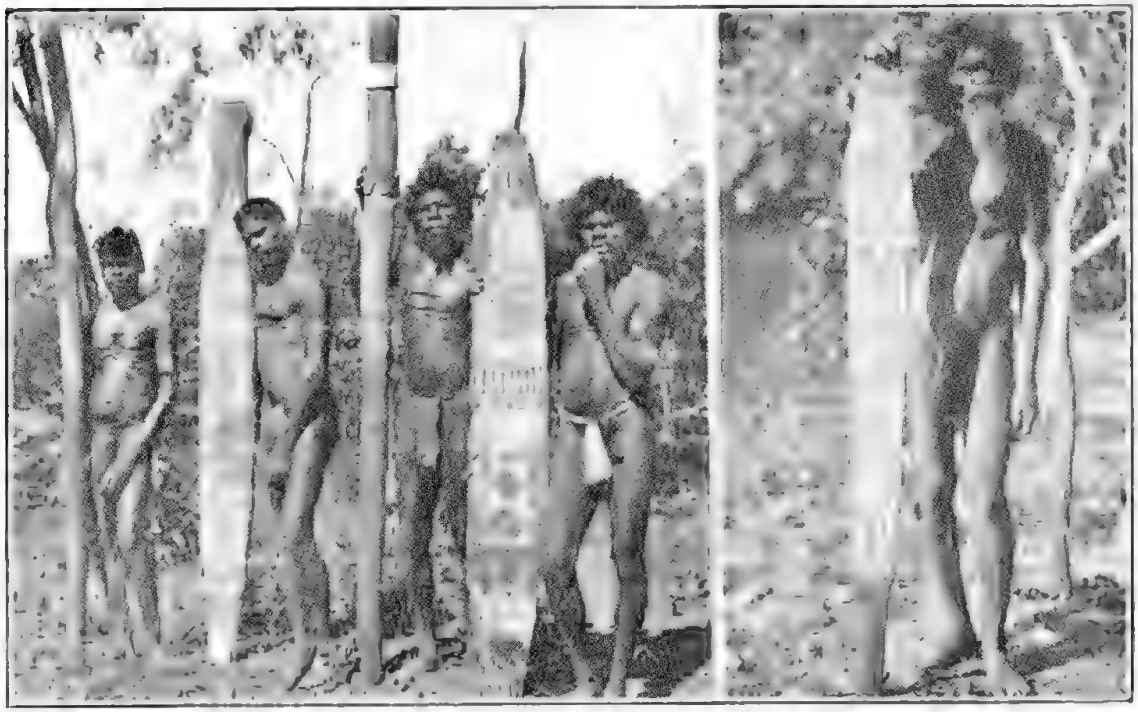


Fig. 29.—Amalipa ceremonial Imudunga. Fig. 30.—Capatama with Imudunga.

In general the cutting of the body is regarded as a sign of courage. A few natives, even of middle age, were without more than the first cut; in particular, one man of the Talakurupa, who lacked the additional cuts, never seemed to take part in any of the many quarrels and fights common to them, and suggestions made that he should fight were received by the others with chuckles of amusement and clicking of tongues.

An example of the rubbing-stone mentioned above was subsequently obtained from a Caledon Bay (Balamumu tribe) native, who carried it in a bag around his neck. It is an oblong piece of thin, blackish stone, somewhat wider at one end; the corners are well rounded off; the edge is round and very smoothly polished. It is three inches in length, two inches in width at the widest part, and of a uniform thickness of about one-quarter of an inch. In text fig. 41 (b and c) a representation of the stone and a diagrammatic section are shown.

Women and Marriage.

One of the outstanding differences in social customs in comparison with the adjacent mainland natives is the general and strict enforcement of seclusion

on the women of the tribe. No native from the time of his initiation until he is of age to marry, and no strangers, are allowed to approach the women, who are compelled to live apart in camps guarded by old men, but they are visited secretly by those entitled to the privilege. The women are in the minority, and are monopolized by the older men, who each have two or more if possible. The rest of the men therefore live together in open camps with some of the old men, collecting the greater part of their own food themselves, but the older ones frequently receive parcels of yams and burrawang cakes from the womenfolk. The younger men, 'wanumamalia,' are not allowed near places where the women are likely to be yam-digging or burrawang-nut gathering, or to look at them, under penalty of spearing. Should a young native accidentally come upon them he must turn away and give warning of his presence.

A 'wanumamalia' on obtaining a wife is called 'naninga,' and bears this title until the signs of increasing age qualify him for the name 'wanjaringa,' or old man. Few of the men under about thirty, unless they are of exceptional prowess, are entitled to the term 'naninga.' One of the youngest was the Nungubuyu man named Banju, mentioned elsewhere, a noted left-handed spear-thrower, who having been allotted an Ingura woman of the Talakurupa group for wife, was compelled to reside with and to submit to the customs of the Ingura tribe. After several years, however, he became restless under this arrangement, and, taking his wife, secretly escaped to the mainland in a canoe manned by his countrymen. On visiting Yetiba again he did so in company with natives of Bartalumbu, with whom he was friendly, leaving his wife at Bickerton Island. The Bartalumbu group, being in intermittent contact with the main land tribes, are less strict at times in their observance of the rules of seclusion, which break down somewhat when visits are made from island to island in canoes.

Aningidi-wunta, a young man of Yetiba, secretly visited the eastern side of the island, and induced a girl (according to his description quite young, and therefore highly valued) to elope with him. Retreating to the main range, he covered his tracks as far as possible, but was traced by his pursuers, the men of Talakurupa, and held up at spears' point. Finding he could not escape, he surrendered his prize, and accompanied the natives back to their camp, where he was forced to undergo a spear-throwing ordeal (similar to that elsewhere described in connection with the Avenging ceremonies), from which, owing to his agility, he escaped without injury. Similar expeditions carried out by young Ingura men on the mainland camps are often successful, and if they are able to maintain their right of possession and escape the vengeance planned by the wrathful former owners of the women, they may finally be regarded as 'naninga' of the tribe. The two above-mentioned occurrences show two methods of obtaining

a wife prevalent among them. In the first the man was definitely assigned a wife in a different tribe, and was compelled, nominally, to live with her tribe. Continual trouble exists between different groups and with the neighbouring tribes over womenfolk.

Old men are sometimes deprived of their wives, and it depends on their influence whether they are assisted to find their former wives or not. When Namamopura, an old Yetiba man, had his two women taken by another man who came from the north, he tried hard to stir up the men of Talakurupa to assist him, but finding them unwilling, set out with his son and one or two others towards Cape Shield (on the mainland) to attempt a recovery. On several of the smaller islands there live solitary old men, practically hermits, who have lost and been unable to regain their women.

For the above reasons no women were seen by any of our party except by accident. On one occasion, when stalking wallaby in the direction of the source of the Yetiba, I met a party of about a dozen women and children walking through long cane-grass, escorted by an old man. My Ingura native companion immediately turned away, while the old man shouted excitedly, waving his hands in the air. The women, after an instant's hesitation, darted quickly away, dragging their children with them. The old man held his ground for a few moments, and then fled after his charges

Recently, after several years of mission work, the natives were induced to bring a party of their women to a place near Yetiba, and Mrs. Dyer ventured with the old men to where they were hiding. She found them to be timid and shy, hiding at first completely behind hinged sheets of stringybark, with which each was provided. Her demonstrations of friendship and their curiosity soon led to a closer acquaintance, and she was able to distribute various gifts to them. In a letter she briefly describes their appearance as follows: "They wore no clothing at all, but when I saw them they looked like so many giant 'Jack in the box.' After they had overcome their shyness they were very interested in me, and crowded around, holding the bark to their bodies, so that it hid them as they walked." The same day Mr. Dyer was also allowed to approach close enough to talk to them, but since then the old men have not permitted them to be seen again.

The tracks of the women and children were noticed in many places in the interior of the island, especially around secluded waterholes, where their deserted camps were several times investigated. An usual feature was the signs of large fires, such as are used for cooking burrawang dampers; piles of burrawang-nut shells were common, and in nearby running streams were often signs indicating that the nuts had been soaked there. On the black-soil flats numerous holes

dug in obtaining yams, and piles of burrawang shells lying beside flat stones, indicated where food had been gathered or partly prepared.

Personal Habits.

The men as soon as possible wear a long, pointed beard, and less often a moustache; the hair on the cheeks and neck being usually removed either by using a pair of shells as forceps or with the fingers. The wearing of this long beard gives the island native a very distinctive appearance, and the mainlanders (Nungubuyu and Mara), when recounting the fierce fighting qualities of their insular neighbours, always emphasize this as adding to their apparent ferocity.

The hair is generally worn as a thick, tangled mop, but less frequently it is kept shorter by singeing or cutting. Much attention is given to the appearance of the hair, and it is often combed out so as to form as large a mop as possible. To do this a native lies down on his back, with his head on the lap of a mate, who inserts a stick, about nine inches in length, into the tangled hair, and jerks it outward until free, the operation being repeated until the hair assumes the erect appearance desired (see text figs. 27 to 30).

Head vermin called 'mi' *(Pediculus capitis)* are searched for and removed during the above combing operation, and disposed of by eating. Many of the natives also have their eyebrows and eyelashes thickly infested with the crab louse *(Phthirius inguinalis)*, which gives their eyebrows a piebald appearance. A native, provided with forceps and a tube of spirit, collected from his mates considerable quantities in a few minutes. For these reasons, on taking several of them into our employ on the ketch, they were induced to remove their surplus hair, and thus the two men on the left in text fig. 29 appear different from the others.

The hair is often dusted with powdered kaolin or red ochre, and on ceremonial occasions a broad white line of kaolin may be plastered into the hair from front to back.

On ceremonial occasions, and during fights, the islanders paint broad bands of white across the front of the body and limbs; occasionally the back also may be so decorated. They seldom use feathers or eagle-down stuck on in intricate patterns with blood, as is the usual practice among the mainlanders. In fact, little or no blood is used, and cuts are not made on the inner part of the thigh for the ceremonial obtaining of blood, as among the Mara, Ngandi, and Ngalakan.

In cold weather, especially at the beginning of the dry season, they frequently coat their bodies with grease and powdered charcoal, causing the skin to appear dark when first applied, but it soon attracts dust and becomes greyish. Others are rubbed all over with powdered ochre, resulting in a copper-coloured appearance.

Disposal of the Dead.

No deaths occurred at Yetiba during our sojourn. An old man of the Talakurupa local group had been killed by one of the Bartalumbu men, and part of the subsequent avenging encounters were witnessed.

On a death taking place there is great commotion and consternation in the camp. A circular space is cleared in the scrub near the place, and preparations made for the disposal of the body. Meanwhile, in the camp chants, which apparently are meaningless, accompanied by drone-pipe music and throwing stick clapping, are kept up for several hours. The ceremony is called 'Yingijungudagena.' Nine or ten feet are cut from a tree hollowed out by termites; the bark is removed, and the outside painted by the older men with a design of lines and dots similar to those on other articles. At the conclusion of the ceremony the body, rolled in a large sheet of paperbark, is placed full-length in the log. Wads of paperbark are inserted at each end, and the coffin is planted upright in the middle of the cleared area, with six or seven feet projecting; a block of coral or stone is then placed as a capping, and the place deserted for some time. Fig. 32 depicts the coffin *in situ* of a child about twelve years of age which died at Winchilsea Island. The coffin and contents were given to me, but later the bones of the child were asked for, and were returned.

Fig. 31. Men of Bartalumbu.

Fig. 32. Coffin at Winchilsea Island (Arichangoa).

After a lapse of time, when decomposition is complete, the bones are removed, cleaned, very often red-ochred, and the major bones and skull replaced in the coffin. At this period, or before, a bone is removed (sometimes an arm bone), wrapped in paperbark, and taken to the camp, where a special ceremony, called 'Alalukiyina,' is performed, with the object of finding out who was responsible for the death of the person.

After a further lapse of time the major bones are collected and placed in caves and crevices in the rock. Each type of bone is deposited in a different place. For example, at Amalipa, several small caves or rock-shelters were discovered, and in one of them were piled up thigh bones; in another were many shoulder-blades; while under a rock at some distance were found lower jaw-bones. In another crevice was a broken skull. The bones are distributed in many places, and there is said to be a cave in the hills behind Angoroko devoted to skulls, but the natives would neither indicate its position nor produce the skulls. On another occasion the major limb bones of a child, wrapped in paperbark, were found in a crevice within a cave near Bartalumbu, and are now in the collection.

Flinders ([9]) discovered four skulls at the back of the beach on Woody Island, to the south of Bickerton Island. An examination of the island revealed no skulls. The island has altered considerably since Flinders' visit, being now only a sandbank about a hundred yards long and twenty yards or so wide, with one small shrub and a patch of grass in the middle. At Cape Barrow he mentions finding skeletons, painted red and white, standing in what he took to be hollow stumps of trees. Such remains may be seen to-day there and at many other places. What Flinders took for hollow stumps were doubtless coffins, similar to those above described. This practice is common to the Balamumu and Nungubuyu tribes also.

Some time after death a ceremony called 'Alalukiyina' is held over a bone of the deceased wrapped in paperbark. Few details were gathered as to the procedure, but it appears that the person on whom responsibility for the death is to be cast is named, and someone, usually a son or other close relation, is deputed to wreak vengeance. The bone, within a specially ornamented bag, is placed on his back and worn during the excursion. The son is accompanied by several mates. Should the named one be discovered while unaware of the meditated attack he is killed, but should he be prepared and be guarded by his companions, arrangements are made for a trial or ordeal, in which the avengers throw numbers of spears at the man from a certain set distance. Should he be speared he is usually despatched, but if he escapes injury he is allowed to go free. Text figs. 33 and 34 show six men of Talakurupa who, one at a time, are preparing

([9]) Flinders, M., l.c., ii, 1814, p. 182.

to, or are in the act of throwing spears at a Bartalumba man, who cannot, however, be seen in the pictures. In the case depicted thirty-six spears were thrown at the man from a distance of thirty yards, but failed to hit him. An elaborate ceremonial marked the conclusion of the ordeal. The bag worn by the son of the deceased is now in the collection, but the bone was not obtained.

Fig. 33. Preparing for avenging spear throwing.

Fig. 34. Son of deceased throwing spear.

Food.

The food supply is plentiful on the island, usually obtained with comparative ease, and this has a marked effect on the physical well being of the natives. Usually they are well nourished, with a tendency to fatness in some of the men of middle age, but their legs always remain thin.

The Ingura rely to a great extent on the products of the sea for their sustenance, and therefore, except when honey and burrawang gathering, hunting or travelling, they live in sheltered bays or in the vicinity of the numerous coastal creeks and tidal swamps. Their habits are nomadic, and in their wanderings they have worn well-defined pads round the island. The general name for food is 'aunnga' or 'unina,' and the 'food gathering' is termed 'aunngaoa.'

The chief vegetable food is not, as on the adjacent mainland, the giant waterlily *(Nymphaea stellata)*, but the fruit of the cycad or burrawang *(Cycas media)*, native name 'mannnga.' A variety of *Nymphaea stellata* (as identified by Mr. J. H. Maiden), which grows only in shallow water in the creek-beds and lagoons, is found on Groote Eylandt, but the natives say it is not edible. At Roper River the giant waterlily never grows in water less than seven feet in depth, dying off as the water recedes below that depth during the dry season. The women, under the charge of an old man, gather the fruit of the burrawang; the outer shell is removed by cracking between two stones; the kernels are broken,

and then soaked for two or more days in running water. To accomplish this a series of rectangular enclosures are laid down in the bed of the stream, the walls being formed of the fronds of the burrawang pinned down with sticks. These enclosures are lined with leaves. The broken nuts are placed in these, covered with other leaves, and the whole held down with stones. The water percolates freely through the frond enclosures, and washes out the poisonous principle in the nuts; after being well soaked they are pounded between stones to a coarse meal, the juice is squeezed out, and after being washed several times, the meal is made up into large cakes, which are cooked in the ashes. The result is a rather coarse but palatable damper. The unwashed nuts are regarded as poisonous; on making pretence of eating them, the natives showed great alarm, exclaiming 'Ya, Ya,' said they were 'aoraria' (no good), and rubbed their stomachs to indicate the result. The seeds of the dwarf pineapple-shaped fruit of the zamia *(Macrozamia miquelii)* are also at times prepared in similar manner.

Yams *(Dioscorea sativa)* grow in profusion in black soil on low-lying ground, and are dug out by the women by means of a sharp-pointed stick, the holes left being two to four feet in depth and seven to twelve inches in diameter. Certain grass-like plants, which grow on stony ground at Yetiba, have an edible root, which the children dig out with a short, sharp-pointed stick. The tender shoots of the fan-palm *(Livistona inermis)*, which grows among the quartzite rocks on the hills, are much sought after during the wet season. Other scrub palms also provide succulent shoots. The fruit of the pandanus *(Pandanus odoratissimus)* is eaten, but it is not much relished, as, except for a small part near the base of the fruit, it is woody.

There are also many trees and vines in the scrubs and forests and along the banks of the freshwater streams which supply edible fruits. A large fruit, belonging to a species of *Eugenia* allied to the rose apple *(Eugenia jambos)*, is found on the river banks. The fruit, which ripens during the wet season, is red, about the size of an apple, but with a large, round seed. In taste it is somewhat tart, but comparable with an apple; it leaves a peculiar dry feeling in the throat, but the natives appear to relish it. Flinders ([10]) mentions that his sailors found numbers of this fruit at Blue Mud Bay and Chasm Island. Overhanging the creeks is a large tree *(Terminalia platycarpa)*, which bears, in November, great quantities of a green plum-like fruit, to obtain which the natives fell the trees or break off large branches. On the stony rises and on well-drained flats grows a native "plum tree" *(Buchanania muelleri)*. It bears a crop of green plum-like fruits right through the wet season, when it forms a considerable part of the food of the natives. In the coastal scrubs, growing amid ancient upraised coral

(10) Flinders, M., *loc cit.*, ii, 1814, p. 203.

reefs, now thinly covered with sandy soil, are gigantic fig trees *(Ficus glomerata)*, the stems of which are often four to eight feet in diameter six feet from the ground. The figs are an inch or more in diameter, reddish in colour, and a trifle insipid, except when fully ripe. The natives term the tree and fruit 'nungarata.' Most of the figs are full of a species of chalcid wasp, 'oragigi.' A similar but smaller tree growing in the same localities bears a larger, bright yellow fig, with a pleasant taste when fully ripe, but the natives do not regard it as edible.

A small shrub *(Grewia polygama)* grows in profusion in some places; the small, nutty fruit is eaten when better food is not obtainable. It is also eaten in cases of diarrhoea. Amongst the Ngandi and Mara people, on the mainland, the plant is less common, and the fruit is regarded as a delicacy, to obtain which they travel long distances in May and June (when it is ripe). A climbing vine *(Cissus)* bears clusters of a dark, grape-like fruit. The taste is very agreeable, but a persistent husky throat is noticed after eating. The natives suck the hollow stems to obtain the water contained therein.

Besides the above-named fruits there are numbers of others which have not been identified. A shrub found commonly in the scrub bears, late in the wet season, a red dumb-bell fruit about an inch in diameter, and of delicious flavour. The natives are also fond of a small native "cucumber," and there is another similar vine which bears an oblong fruit having the taste of a ripe banana.

Apart from the indigenous fruits the tamarind *(Tamarindus indicus)* is plentiful wherever Malays had their camps in bygone days. Surrounding these camps there are usually groves of the trees, and one seen at Winchilsea Island was fully four feet in diameter at the base, and probably sixty feet in height. The fruit, a brown, bean-like pod, containing several obovate seeds surrounded by an acid pulp, is eaten in great quantities when other food is not plentiful.

Coconuts ('kalukwa') are much appreciated among the Ingura and Balanumnu. The sea currents at certain periods of the year bring great numbers of drift coconuts to their coasts; they sometimes germinate, but owing to the improvident nature of the inhabitants, no palm has ever become established. Young nuts planted by our party were invariably dug up, and the tender portions eaten.

The principal animal food of the islanders is the dugong *(Halicore australis)*, on the north and west coasts, and turtle and turtles' eggs on the eastern and southern sides. On the north-west coasts the sheltered bays encourage a liberal growth of the sea grasses so favoured by the mammal. The dugong is hunted by the natives in canoes and captured by harpooning. The harpoon is long and tapering, fifteen to sixteen feet in length; in the thick end is a hole about two inches deep, into which a short, wooden, barbed spike, about one foot in length, is inserted, and held in position by a wrapping of string about its base making

a bare fit. Attached firmly to this spike is about thirty yards of strong native rope (about one-quarter inch in diameter), secured at the other end to a light wood float. The float is made of exceptionally light wood which is not native to the island, but is occasionally found as drift wood; it is much prized because of its use. The float is fixed into the bow of the canoe, so that a fair strain will dislodge it.

Hunting is usually done on calm, moonless nights, for then the animal can be well seen and its breathing heard as it moves through the phosphorescent water. Five or more men generally form a crew. The soft snorting noise as the animal breathes can be heard for a quarter of a mile under favourable conditions. Slowly they paddle toward the animal's position, in absolute silence, directed by the harpooner, who, spear in hand, stands in the bows. He holds the spear with the hands widely apart, the right one grasping the extreme end, so that by levering on the left hand the heavy end bends the harpoon into a graceful curve. Several coils of the rope are held in the left hand; and as the canoe drifts silently within striking distance, the straining figure hurls the harpoon, adding his own weight as he pitches into the water. With a swirl the wounded creature commences a struggle for life; the rest of the line is payed out, and the end held as long as the strain will allow without breaking the rope or swamping the canoe. Often a float is let go, and then the natives paddle after the animal, which, weakened by loss of blood and the restraint of rope and float, comes to the surface, and is despatched with an ordinary spear. When it is dead the canoe is submerged, and the animal floated into it, and then by catching hold of one end of the waterlogged canoe, two men (treading water) rock it from side to side in such a manner that the water is thrown out, and in a few moments it is buoyant again. One then clambers in over the stern, carefully balancing so as not to overturn the round-bottomed vessel (a difficult performance), and finishes bailing the canoe; the rest then clamber in over the sides with comparative ease, being assisted by the balancing efforts of the first man. Arriving at camp, a signal fire is lighted, and members of the tribe gather for the meal. The dugong is thrown on the beach, and cut into slabs and strips, regardless of the sand, which penetrates deep into the soft flesh. The entrails are regarded as a delicacy, and are roughly washed before cooking.

Turtles are similarly harpooned in the daytime; they are also taken commonly when egg-laying. At certain seasons the eggs are the principal food of the natives of the east side of the island, where the sandy beaches are much frequented by the reptiles. Tortoises ('imoraga') are also frequently taken, as are the eggs and young of the crocodile ('dougarapia'), but the adults are not usually molested.

The agile wallaby *(Macropus agilis)* is extremely plentiful, and numbers are killed by the natives. The pursuit is arduous, and requires skill; it is therefore undertaken mainly by the younger men. A special form of spear, elsewhere described, is used, and the creatures are stalked up the wind when feeding, generally at dusk. Having approached to within ten yards or less, the spear is hurled, and seldom misses its mark. Another method is to fire a semicircular area of dry-grass country, watchers being stationed at the unburnt side. As the frightened wallabies and other animals attempt to escape they are speared. Dogs are also used to catch the smaller creatures that appear, such as bandicoots, rats ('orandinda'), and lizards ('dungatua'). Bandicoots and lizards sheltering in hollow stumps of pandanus trees and in rotten logs are ousted and killed by dogs. Porcupines ('dinginnga') are common, and are carried wrapped in a piece of bark. Flying opossums *(Petaurus)* are often taken during the day when asleep in hollow trees, or when disturbed by honey gatherers. The flesh is much appreciated, and the fur is used in ornamenting armlets and in making fur-string. Flying foxes ('unnmulgu') are eaten, but not the smaller insectivorous bats.

Native companions ('nguruku'), jabirus ('dunnukulia'), and black cockatoos are frequently stalked and speared. The two former birds commonly parade along the seashore in search of dead fish and other marine debris, and are easily speared by men hiding in the coastal scrub. The lorikeet (called 'magijia') and smaller birds are taken by stone-throwing.

The mound-building scrub fowl *(Megapodius reinwardt)* is common all over the archipelago, and provides a regular supply of large eggs. The natives do not usually molest the birds, but the nests are frequently rifled. The native scratches in the mound with both hands, following the trend of the hole excavated by the bird; he throws the debris backwards through his legs, and gradually disappears head first into the excavation, while a second native assists by removing the material as it is thrown up. In this way the digger sometimes goes down six feet before reaching the eggs. Newly hatched birds uncovered in this manner are killed and eaten. The eggs are prepared by breaking a hole in one side and are cooked, hole uppermost, on the fire.

Fish ('akwaia') are plentiful around the island, and various devices are employed to catch them, fishing over the reefs with hook and line being the principal mode. Bait is obtained by digging out of the sand with the hands various beach crabs *(Ocypoda)*. They are usually dismembered and placed in a bark dish shielded from the sun. The canoe is anchored over a suitable spot, the hooks baited with the fleshy part of the crab, the hard parts being used as ground-bait. The line is made of hibiscus bark cord, and the present-day hook is an iron nail ('bigangi'). Endeavours were made to find out what hooks were in use previously, but they have obtained metal for so long a period, from Malay traders,

from wreckage, and in recent years by trade from the mainland tribes, that no other hooks are now known. The nail has the head ground off, is finely pointed, and bent abruptly in two places to form the hook (text fig. 41 d). It is lashed to the cord with fine twine. Barbed hooks are not in great demand, and when used, the barb is ground off, and the hook lashed on in the same fashion as the nail, the idea of using the eye being unappreciated by them. When a fish is caught it is killed by crushing in the top of the head with the teeth, but if larger, a throwing-stick is used. The catch is generally piled up in the waist of the craft, but in hot weather may be strung on a cord and trailed in the water. On return to land the fish are cooked on the camp fire. Certain fishes, such as stingrays and sharks, are subjected to a more elaborate mode of cooking, which is described elsewhere.

Spearing is another favourite method of obtaining fish. When a canoe is used a native sits in the stern and paddles quietly along, while a second stands with poised spear in the bows. In this fashion the shallow waters along the shore and over the coral reefs yield stingrays, mullet, and groper. The chief essential is perfect quietness both in the manipulation of the paddle and in the directions given by the spearer; a series of signs are made use of. When signalling the left arm hangs loosely down; if the hand is held showing the palm to the one behind he ceases paddling. To go forward the hand is pointed forward, palm down, and the fingers are moved together, as though beckoning, quickly if speed, slowly if merely a stroke is required. The direction right or left is indicated by the position of the hand, supplemented by that of the spear and body. After an unsuccessful throw or reconnoitre, "no luck" is indicated by opening the hand, with the four fingers pointing forward and the thumb extended to the right, and partly revolving the hand in a clockwise direction. A crocodile is indicated by turning the head somewhat to the left, opening the mouth wide, and passing the forefinger of the left hand in front of it from right to left.

Tidal creeks provide a good supply of fish. At high tide a barrier of mangrove branches, leaves, and grass is thrown across an estuary, leaving a gap about two feet in width near one side. As the tide falls the migrating fish are there speared by waiting natives.

For a week at the end of February shoals of a marine Grey Mullet about three inches in length came up the creek at Yetiba, to fresh water, and endeavoured to leap a waterfall about four feet in height. The natives placed a sheet of paperbark supported on sticks beneath the fall, on which such fish as failed in the leap fell. Great numbers were taken, and eaten raw, or after cooking for a few moments.

No net is apparently used for fishing. It was explained that the fish were usually large, and nets would get broken. On the mainland small freshwater fish are often caught by driving them into hand-nets.

In the sheltered muddy bay at Bartalumbu great numbers of a large bivalve mollusc *(Arca trapezia)* are found buried in the mud. Canoe loads are gathered, and are eaten either raw or cooked on the fire for a few minutes. The shells are to be found in immense numbers, forming mounds around the camping sites. Freshwater mussels *(Unio)* are also found, but less plentifully. On the mainland the Nungubuyu and inland tribes eat great quantities of these mussels.

Honey is a much sought delicacy. Stingless native bees *(Trigona)* often makes their homes in the hollow stems of the stringybark gum *(Eucalyptus tetrodonta.)* A native as he walks along may notice the minute hole which the bees are using, or more often, he proceeds from tree to tree, tapping each, until he discovers a hollow one, when, placing his ear against the trunk, he listens for sounds of the bees' activity. On locating a swarm he climbs the tree, and by cutting away the bark and making a groove in the wood, removes the entire nest and places it in a bark dish. If the nest is inaccessible the tree is felled and split. Nests built in fissures in rocks cannot always be removed; in this case a long, thin stick is inserted in the crevice and twisted about, the adhering honey being sucked off.

A favourite method of eating honey is to place wads of soft, dry grass in the dish containing it; these when saturated are removed and chewed. The pulpy mass of grass and adhering wax is spat out, to the gratification of the dogs, which chew the pellets for the sake of any honey remaining. The practice is widely spread among the Gulf tribes, and when suitable grass is not available the soft inner-bark of the "lancewood" is used. The wax is usually saved for the manufacture and repair of weapons, etc.

During the wet season the yellow flowers of a Bottle-brush *(Banksia dentata)* are made to yield their nectar by striking the large brush-like flowers into the palm of the hand, which is then licked. A boy, Krala by name, was noticed doing this, and on my trying, a not inconsiderable quantity of sweet nectar was obtained in a few moments.

Several species of lerp insects *(Psyllidae)* secrete a sugary substance, which is found adhering in scales to the bark of wattle and other trees, and these are eaten. Honey ants (*Camponotus* spp.) are not known to the islanders, but among the inland tribes, such as the Rittarungo, they are eagerly sought for.

All food which is not eaten on the spot is considered to belong to the camping group as a whole, and on arrival at camp is apportioned, only those present receiving a share. The old men receive a full share, the remainder being divided among the younger ones. Old men do not go out for food as a rule, but if the food supply remains low they will sometimes take a boy or two and go out fishing; usually most of their time is spent in making spears. There is a definite food-sharing custom. A certain native, sometimes a young man, is regarded as

the distributor of food, which is always brought to him to be shared. Among the people of Talakurupa a middle-aged man named Machap-munji performed this office. The description of a meal will give an idea of the procedure. A young man brought a parcel of edible roots wrapped in paperbark to the camp at Yetiba. Placing the parcel before Machap-munji, who was seated among other natives, he sat down at a distance. Turning his back on the rest of the party Machap-munji sorted out the roots, and, retaining one for himself, picked up the others share by share, and passed them behind his back to the one next to him. Each old man received two roots, and younger men one each. Finally, there being one over, it was carelessly slung to an old man of a neighbouring sub-tribe. The roots were simply dusted by running them through the fingers, and eaten. The native who brought in the parcel of food received nothing, and remained apart until the meal was finished. Among the men of Bartalumbu cooked dugong and turtle flesh were distributed in similar manner, a native named Yerndenya being the distributor. Unless there is an abundance of food, the one who obtains it receives no share, and it was found necessary when employing natives to make them eat the food provided before leaving for their own camp, otherwise it would be shared. Previous to making this rule it was impossible to get a native to work for more than two consecutive days, for, becoming hungry, he would disappear to obtain food for himself.

Fig. 35. Cooking dugong flesh; placing entrails in oven.

Fig 36. Covering oven with hot ashes and soil.

When two groups of natives form adjacent camps food is not shared in the ordinary way. However, if a dugong or turtle is brought into one camp there is often a mock demonstration of hostility; angry voices are raised in challenges and jeers; sometimes spears may be thrown by either side. Peace, however, is

restored by an invitation to share the food, which is eaten separately in the two camps.

Dugongs, turtles, and other large animals are cooked in a form of oven. Stones are thoroughly heated in large fires lit in depressions in the sandy soil; the fire is raked out, and strips and pieces of flesh are spread in the depression, covered with cycad or gum leaves, and then with the hot stones, the ashes and embers being raked back over the whole (see text figs. 35 and 36). The food is often only partially cooked when withdrawn from the oven and distributed. Strips of flesh are often scorched in the fire and hung up in the sun to dry, and may thus be kept for a week or more.

Turtles are laid in the oven on their backs, and after several hours' cooking are taken out and cut up, the entrails being removed, washed, and replaced on the fire. Owing to this treatment much of the shell is useless for trade.

Large stingrays and sharks are cooked in a more elaborate manner. After the creature has been gutted and placed on the fire for a few moments, it is cut into small portions and passed round to those in camp, who tear the portions with their teeth and chew them, forming the pulpy mass into balls with their fingers. Several pounds of this article are spread out on a sheet of bark, fat derived from the creature is placed on it, and a small fire formed of two sticks laid over the whole. The fat melts, and is absorbed in the mass, which after being kneaded up well is made into flat cakes and baked in the ashes.

Amalipa Ceremonies.

When examining the hills at the sources of Amalipa Creek, flowing into Spencer Bay, during July, 1921, our accompanying natives, an Ingura and a Ningubuyu, pointed out a swamp containing many paperbark trees, a prominent landmark on entering the bay, as the site of a secret ceremonial ground. On investigation we first found a cleared circular area in the dense scrub, with a tree near its middle. This was a place where Unamalia-maindi operations and other initiatory ceremonies take place. Against the protests of the natives, who, however, followed us, we proceeded further into the scrub, and on the border of the big swamp found a number of dilapidated huts in a partial clearing. One hut, however, was evidently new (hut A in text fig. 37); it was about ten feet long, eight wide, and six high. Six forked upright poles had been placed in the ground, three at each end, and supported on these were three poles, placed lengthwise. The middle pair of uprights were higher than the others, and therefore the roof, formed of large sheets of paperbark laid over transversely-placed sticks, was a sloping one. Three sides were formed of sheets of bark, but one end, except for the upright, remained open. Near the inner end were two mounds of sandy soil, each supporting an upright decorated pole. These were each about four feet high and four inches in diameter. Both were red-ochred, and one had a painted

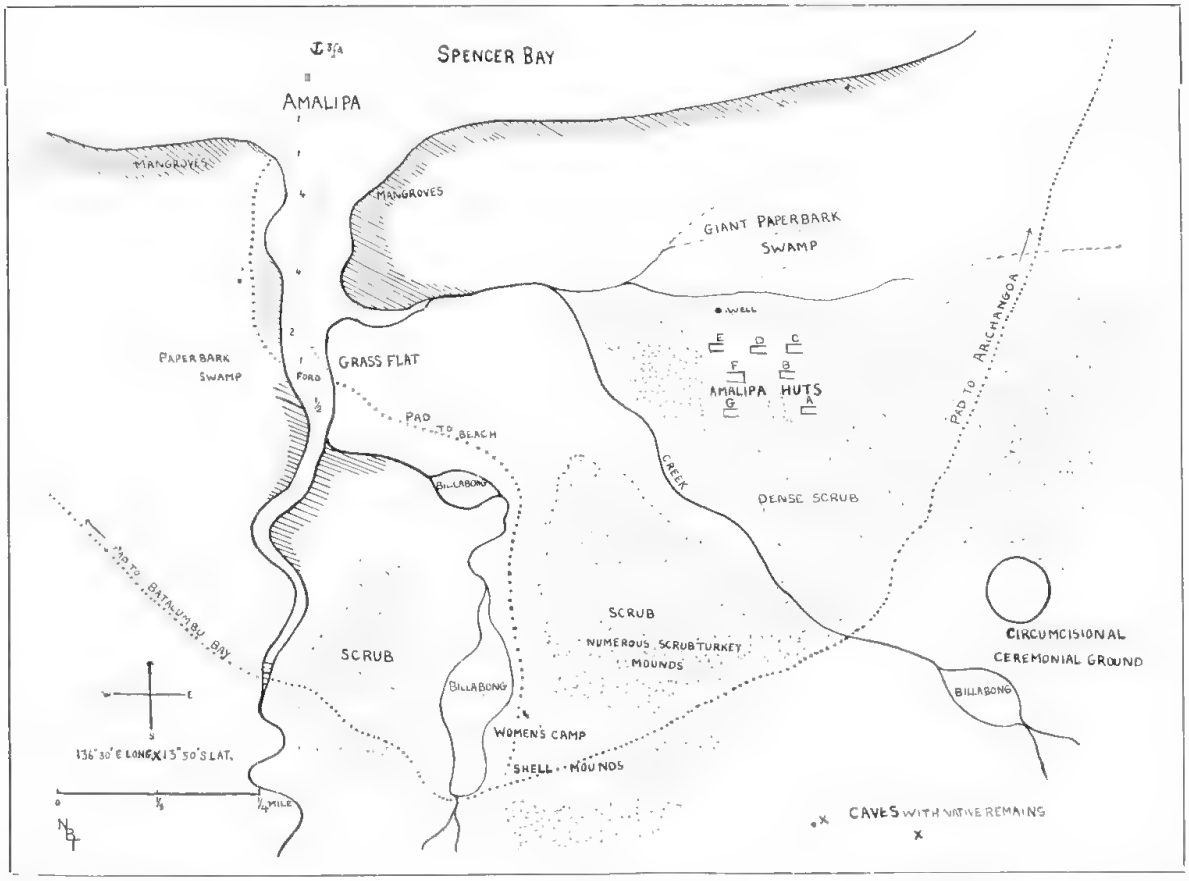


Fig. 37. Sketch map showing Amalipa and the ceremonial ground.

design in white, yellow, and black. The sand of the floor was cleanly brushed, while outside the hut the ground showed many footprints. On the occasion of a second visit under the guidance of the chief old man of the Bartalumbu group, the hut was found to have suffered from the storms of the wet season and the fall of a tree, but beneath the wreckage the two poles were found as before. The old man brought them out willingly. Text fig. 37 shows the positions of the different huts seen. In hut B, which was in ruins, he dug in the floor at the inner end, and produced two poles of a soft wood (similar to those in hut A), wrapped in sheets of bark. These were too termite-eaten to bear transport. Hut C, next visited, had been a large one, and more substantially built than the others, but was apparently several seasons old and in ruins also. In it were buried six large decorated slabs of the same significance as the others, made from a soft wood. The four lower ones were termite-eaten, but the upper two wrapped in a parcel by themselves, had escaped serious injury. A round one, similar to those in hut A, was found in the parcel containing the four flat ones, but it was very much decayed, and after being sketched (text fig. 38) was replaced. Hut D contained merely a parcel of termite debris beneath a mass of decaying paperbark and wooden poles. It was evidently the oldest of which traces could

be found. Hut E was also in ruins, and the only poles noticed were two of hardwood, with only traces of their original colouring remaining, lying below a tangle of uprights and roof sticks. F, the largest of the former huts, was fully eighteen feet long and twelve wide. The roof had fallen in, but the uprights were all standing. One large, painted hardwood pole, about eight feet in length, was found buried in the hut. A second could not be found, although a careful search was made by the old man, who was positive there should have been another. Hut G was marked only by a few sticks and much debris; it contained nothing of interest.

Fig. 38. Inundunga found in hut C.

In hut C was also found an old dancing staff painted red, yellow, and black, and with remnants of fur streamers attached. Later on, showing this stick to a middle-aged man, I was informed of the proceedings at the ceremonies held at Amalipa.

The ceremonies at Amalipa are totemic in character, and take place about once a year at one of at least three places, Amalipa, Makalaoba (Bickerton Island), or on the mainland at Wendanga (Cape Barrow). When held at Amalipa the Ingura only attend, but when at Makalaoba parties of natives of the Nungubuyu tribe are frequently present also; and when Wendanga is the chosen place the Talakurupa group of the Ingura are generally absent. Similar ceremonies are also held by the Nungubuyu at Numburuwa (Rose River), where the Ingura do not attend.

The leader of the ceremonies is an old man named Nokwari or Neniamukwa, belonging to the Bartalumba section of the tribe (the man marked in text fig. 31 by a ⊗). He is a fiery-tempered individual, a noted spear-thrower, and a magician. He has considerable power over thunder-storms and over rain, which he frequently produces during the "wet" season by his magical singing, and as easily causes to cease by similar means.

Having decided to hold a ceremony, messengers, with painted message-sticks as passports, are sent to visit the various sections of the tribe some weeks beforehand. Meanwhile Nokwari, assisted by other old men, cuts and ornaments from two to six large poles. The natives arrive in parties, bringing food, such as roots, turtle-eggs, and honey, sufficient to last over the period of ceremonies. A space is cleared adjoining the clearing and hut used on former occasions, and a new hut is constructed. The decorated poles are placed within in an upright position, and the dancing and singing commences. Mimic dances ('abunnayang-

pena'), illustrating the habits, attitudes, and other peculiarities of certain animals and birds are performed in front of and around the hut, with the object of causing an abundant supply of the creatures during the following season. The following totem animals and birds are subjects: Dugongs *(Halicore australis)*, wallabies *(Macropus agilis)*, bandicoots *(Perameles)*, porcupines *(Echidna aculeata)*, lorikeets *(Trichoglossus rubritorquis)*, native companions *(Antigone rubicunda)*, crane *(Demiegretta sacra)*, and turtles *(Chelone)*. There are probably others; for instance, among the Nungubuyu, the 'ayak,' or giant water-lily *(Nymphaea stellata)* is the subject of a ceremony. Several hours may be devoted to the dance, featuring one particular creature, after which there follows a period of preparation for another. The performers have their bodies decorated with transverse bands of colour, a broad band of white clay is plastered into their hair, and they wear bunches of ironwood leaves tied to their legs.

The performers carry decorated staves in their hands or between their teeth while performing many of the dances: these staves symbolize the particular totem whose dance is being performed. Miniatures of the poles are also made and used in the ceremonies, being placed upright in the ground, or sometimes carried in the hands. The music is provided by the drone-pipe and by the hitting together of throwing or other sticks. The young men are first allowed to see the ceremonies at about the age of eighteen, but nothing was learned as to the method of introduction. The women are not allowed to witness the ceremonies. At Amalipa the women's camp is situated about half a mile further inland, and is indicated, as mentioned before, by the signs of the preparation of burrawang damper. Nearer the creek, beside a lagoon, is the men's camp, which is marked by large mounds of shells.

After the ceremonies are over the poles are wrapped in paperbark and buried in the floor of the hut, which is then abandoned. New poles and huts are invariably used for each fresh period of ceremonies. In the recent hut (A) the poles were standing *in situ*, and it appears that this was because the news of the white man's landing on another part of the island had brought ceremonies in progress to an abrupt conclusion.

The site of the huts is not visited except on occasions of the ceremonies, and the native pad from Bartalumbu to North-west Bay makes a detour inland so as to avoid the place. The poles were given to me, but the old men asked that they should not be exposed to the young men and boys, and they provided wrappings of paperbark for them. When photographing text fig. 29 the young initiates and several of the younger men were confined to the camp under the care of an old man.

The poles are not regarded as idols, as is suggested in a note by Warren [11]

(11) Warren, H., l.c. 1918, p. 8.

who first described objects of this type from Rose River (Nungubuyu tribe). The rag remains mentioned in his account are not foreign materials, but native fur-string.

The poles and slabs used in the Amalipa ceremonies are known as 'imudunga.' They are used in pairs, each being of similar shape, but often differing considerably in the extent and style of decoration, depending largely on the artists' skill and inclinations. No two pairs are alike, but may be recognized as belonging to three different types: (a) Plain round poles; (b) Shaped round poles; and (c) Shaped slabs.

Examples of the first-named type have already been mentioned in the account of the finding of the pair of poles *in situ*. One of the pair is figured in text fig 29 (a); the other is similar in size and shape, but is without ornamentation. Both are made from softwood, and that figured has a design of straight lines, cubes, and circles in white, yellow, and black on a red background.

In text fig. 29 (c) is seen a round pole of the second type, cut from a piece of ironwood *(Erythrophlaeum)*: it is of considerable weight, old, and tough. Almost the whole of the sap-wood has been chipped off, leaving two collars, the upper one a plain ring of sap-wood, the other cut forming a chain of octagonal figures. The head part is cut to a four-sided figure. The design is much obliterated by weathering and incrustations of termite excreta, but is similar to that of the others, consisting entirely of straight line designs and dots. It was found in hut F.

Text fig. 29 (b) and (d) shows a pair of the shaped-slab type removed from hut C. The head of one is rather obscurely truncate and constricted below, and the other tapers off, with the head part flattened. The designs on both are similar, but were doubtless painted by different persons using red ochres of two different shades.

Text fig. 30 shows another but recent example of the last type, made and brought up secretly at night by the man shown in the illustration, one of those responsible for the construction of the Amalipa poles.

Spencer [12] described and figured six examples of the above-mentioned slap type obtained on the island by the members of H. L. White's ornithological expedition, during the earlier part of our sojourn there, but stated that nothing was definitely known about them.

Ceremonial objects which are similar in appearance to the 'imudunga,' but always of small size, are used in the Amalipa ceremonies. They are called

[12] Spencer, Baldwin, Guide to Australian Ethnological Collection, 3rd ed., 1922, p. 102, pl. 20.

'yummuttungu,' a name which is similar to 'imudunga.' They are sometimes carried in the hand, but usually placed upright in the ground; the same secrecy is maintained about them as in the case of the larger ones. Several examples were brought up, wrapped in paperbark, at night, by individual old men. Like the larger ones, they are used right through the series of ceremonies held at any one time.

Usually they are made of a thin slab of pine-wood *(Callitris)*, split out of the stem of the living tree. Trees mutilated for the purposes of making ceremonial objects and paddles are commonly noticed on the island. The 'yummuttungu' vary from eighteen to twenty-seven inches in length, and from one to four in width. The upper end is usually shaped, several general forms being common, one in which the head is truncate, another in which there are two erect projections at the extremities of the sides, and others with the upper part tapered or rectangular. The lower end is always tapered to permit of its being placed in the ground. The colour patterns are similar to those in the large poles. In pl. vi the red and yellow patterns have not reproduced very clearly. In the example shown in pl. vi, fig. 15, the head portion forms a six-sided figure with a distinct constriction below it. Pl. vi, fig. 12, possesses streamers of possum-fur.

Pl. vi, figs. 11, 22-24, depict objects of less sacred significance, said to be held in both hands during corrobborees ('maiyungena'). In these objects the two ends are similar in shape; they are marked with four-colour designs in lines and coarse dots. They were obtained from Talakurupa men at a place on the eastern side of the island, where they were noticed lying openly in the camp. They are probably used for camp dances in the same manner as the grass and string imitation boomerangs are used among the Allawa and Mara.

Dancing staves or sticks are carried in the hand or held in the mouth of the performers during certain of the Amalipa ceremonies. The showing of the old example found in hut C at Amalipa led to its recognition by a middle-aged man, Rinkamaru, who described and illustrated the proceedings on the occasion when that particular hut had been the scene of the ceremonies some years previously. Placing transverse marks on his body with dust, in imitation of the coloured bands used, and tying bunches of ironwood leaves on his ankles, he gave a demonstration of the dance in the Bandicoot Totem ceremony, for which the staff was constructed. The staff was held in the hand, and at times in the mouth. As the mimic dance proceeded the time beaten on two sticks by another increased, until the performer retired exhausted. In the real ceremony others would join him and take his place.

The old bandicoot totem staff is shown in pl. vi, fig. 3. It is about eighteen inches in length, painted in bands of black, white, and yellow, but the design has mostly been obliterated. Formerly it had streamers of animal fur, somewhat as in those mentioned below.

Pl. vi. fig. 6, shows a plain stick to which streamers of lorikeet feathers are attached. It is used during the performance of the Lorikeet Totem ceremony. Pl. vi, figs. 4 and 5, 7 to 12, show other dancing staves representing totem animals, whose names were not ascertained. Pl. vi. fig. 2, is of a similar ceremonial object carried during the performance of a Spear dance, but whether at the Amalipa ceremonies or at corrobborees was not ascertained.

The message sticks sent out by the old men to announce the holding of ceremonies have no actual message depicted on them, being merely evidences of good faith; the recognition of the style of painting peculiar to the sender being a guarantee that the verbal message has authority. Pl. x. figs. 79 and 80, show examples of message sticks used by the islanders. The sticks are from eight to nine inches in length, nearly rectangular, with one end slightly tapered off. They are ornamented on both sides with a pattern of white and yellow lines; red appears as the background in seven or eight transverse bars, the background of the rest being black.

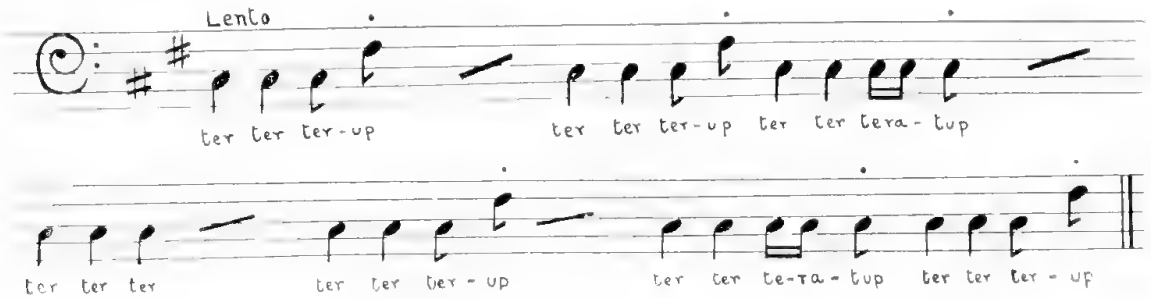
Music.

The chief musical instrument is the drone-pipe or 'yeraka.' It is a hollow stick between three and four feet six inches in length and two inches or less in diameter. A dry branch of the ironwood *(Erythrophlaeum laboucherii)* hollowed out by termites is much favoured, failing which a length of stringybark or other wood. A likely stick is cut rather longer than the finished pipe is required, the narrow or mouth-end is first shaped. This is cut out with a smooth, rounded edge, somewhat concave when viewed from the lateral aspect, so as to fit the mouth, and a mouthpiece of beeswax and gum added. All cracks in the dried stick are filled with gum, and the stick is placed in a creek or pond to soak. When the wood has swollen so as to render the pipe airtight (this is tested by placing the palm of the hand over one end and blowing through the other) the tone of the instrument is tried. If it is not considered satisfactory, a short portion of the unfinished end is cut off. After tuning has been satisfactorily accomplished, the drone-pipe may be ornamented in bands of white, red, yellow, and black, and is then ready for use. Suitable hollow sticks are not easily obtained, and many drone pipes in use are made from crooked sticks; if the one chosen is very much cracked it is wrapped in layers of paperbark and bound around with flat strands of the inner bark of the hibiscus. Not only must the pipe be correctly tuned, but it should be so thin that on flicking it with the finger-nail it gives good resonance. This tapping on Groote Eylandt often enters into the music, and therefore the best-liked pipes are those which have not been wrapped. When not in use the pipe is always left lying in water, so as to keep the wood swollen. A drone-pipe which has been left to dry for some time is difficult to blow with the proper tone and volume

Pl. vii, figs. 27 to 30, represents painted examples of the unwrapped 'yeraka.' The patterns usually consist of rings of several colours. In each figure the mouth-end is placed to the right. Pl. vii, fig. 31, had been left soaking for some time, and all traces of colour have vanished. The notes of the 'yeraka' shown in pl. vii, fig. 28, were tested and found to correspond to C sharp and F sharp in the bass clef. The one shown in pl. vii, fig. 32, has been wrapped in paperbark and tightly bound with flat strips of hibiscus fibre.

In blowing the pipe the performer generally sits on the ground, with his legs extended before him, rests his elbows on his knees, and grasps the drone pipe near the mouthpiece with the left hand, pressing it firmly to his lips. The other hand is free either to stay the pipe or to play the accompaniment by tapping with the finger-nail on the side of the pipe. The other end is rested against a hollow piece of wood, which acts as a form of resonator, or failing this, supported between the big and first toes of the foot. The breath is taken, sometimes, as a cornetist, by lifting up the corners of the mouth without removing the instrument from the lips, at others by drawing in through the pipe. Some players are able to draw in through the nose without more than the barest perceptible pause, but after several minutes they have to stop and take a deep breath or two, as this method causes exhaustion.

The music varies in different localities, both as to the sequence of the notes and the time. The general idea of the music is a low, droning sound kept up for a longer or shorter period, with a higher note at intervals, the music often ending abruptly on either the high or low note by stopping the aperture in the pipe with the tongue. The sound is produced by repeating word sounds into the pipe. The words used by the Ingura are "ter, ter, terup; (repeated) . . . ter, ter, teratup; ter, ter, terup; (repeated) . . ." The first two and a half beats are on a lower note, and the other half beat on a higher one. Variations are introduced at intervals. A common one replaces the last two half-notes of the bar by two semi-quavers and a quaver on the lower note. Another is noticed when the blower continues for a longer or shorter period on the lower note without introducing the higher one. Certain players introduce peculiar variations that cannot be easily explained. An attempt was made to write down a few bars of the drone-pipe music:



Young boys are taught to blow the drone-pipe as soon as they become attached to the men's camp; apt pupils are noticed continually practising when in camp. Owing to the severe tax on the lungs in many of the more difficult styles of drone-pipe blowing, some of the older players have developed deep breathing to a marked extent, so much so that, having taken a deep breath, their abdomen becomes distended in a striking manner, like a rubber balloon.

Not only is the drone-pipe used by the natives in ceremonial dances and to pass idle hours of the day, but is the almost invariable accompaniment to their sleep. In a sleeping camp, as one player becomes tired, he wakes the one next to him, who continues in his place. So necessary is this music to the natives that on one occasion at Yetiba a party of them who lacked a drone-pipe were unable to sleep, and waking me, begged the loan of one from my collection. The next morning the manufacture of a new one was witnessed.

When watchfulness is necessary, or danger apprehended at night-time, the drone-pipe is employed, together with singing, to pass the time and keep all awake; its somnolent effects are then counteracted by the accompaniment of singing and vigorous clapping together of sticks. When blood-feud fights were in progress between two parties at Yetiba in December, 1921, two were kept in use all night in each of the opposing camps (situated about 300 yards apart). Occasionally the drone-pipe is used as a signal, being blown very loudly to indicate to scattered parties that a dugong or turtle has been captured and brought ashore.

The Inguta drone-pipe is usually half as long again and of larger diameter than that in common use by the Mara, Ngandi, and other inland tribes; and therefore gives a lower note. Our mainlander assistants could at first scarcely blow them, owing to the extra air required. The bamboo of the north coast of Arnhem Land does not grow on Groote Eylandt, and consequently no examples of the bamboo drone-pipe were met with.

Weapons.

The chief weapons of the islanders are spears, of which there are many varieties in use. They may be conveniently classed as: Fish spears; dugong spears or harpoons; hunting spears; and fighting spears.

The workmanship displayed in the island-made spears is superior to that of the mainland tribes. For instance, shafts of spears are seldom, except in the dugong spear, made from a plain sapling, but are split out of the log and worked up into shape with knives, scrapers, and rubbing-stones. Some spears used on the island are not of local origin, but are acquired by trading. All spears, except the dugong spear, are constructed with the depression in the end of the shaft to fit the throwing stick, and are not used as javelins or lances.

Fish Spears.

The fish spears ('makuru') are of several types. One is made with a hardwood shaft, from nine to eleven feet in length, with two, occasionally three, barbed hardwood prongs bound on, the barbs facing each other to prevent the prongs being forced apart; they are lashed several inches above their bases. An example is figured in pl. viii, fig. 47. The shaft is of stringybark *(Eucalyptus tetradonta)*, and the prongs of 'memberuko' *(Erythrophlaeum)*. As the spears are heavy (twenty-two ounces) and sink, they are usually used only when spearing big fish, such as stingrays, sharks, and groper in shallow water. For deeper water, or for use from canoes in creeks and estuaries, the heavy shaft is replaced by one of white softwood commonly found in the rain-forest, and the spear floats upright, owing to the greater weight of the head. An example is figured in pl. viii, fig. 48. Although larger than that shown in fig. 47, it is very much lighter (sixteen ounces). In another form caudal spines of the stingray are bound to a shaft in sets of from three to five; such spears are greatly prized, and their owners would not part with them. After our second visit to the island these spears were largely replaced by four-pronged fencing-wire ones.

Dugong Spears.

The dugong spear, or harpoon, which is used by the men of Bartalumbu, consists of a long, thin sapling ('iningulangu yatta'), sometimes over fifteen feet in length and two inches in diameter, tapering to about three-quarters of an inch at the smaller end. The large end has a hole about an inch deep, and to prevent splitting is bound round with string. Into the socket thus formed is inserted a short spear-head ('baju'), barbed on one side, bound with cord at the base, and with a long line attached. The 'baju' used to be made of ironwood or stringybark, but after the arrival of our party they were replaced by eight-inch nails; in these the head is bound round with string to form a plug for insertion in the socket of the shaft.

The entire spear is termed 'anulganulba,' and in the specimen figured (pl. vii, figs. 25 and 26), the total length, including the head is sixteen feet, and without the rope weighs just over five pounds. The float is a special light kind of drift-wood which is sometimes cast up on the beaches. Its place of origin, like that of drift coconuts previously mentioned, is possibly New Guinea.

Hunting Spears.

Hunting spears are usually not more than eight feet in length, slender, and comparatively light. They are cut from a tough piece of hardwood, in one piece. The head is sharpened and hardened in the fire, and is without barbs. The example shown in pl. viii, fig. 49, is seven feet nine inches in length, and weighs only nine ounces.

The hunting spear is largely used for wallabies (*Macropus agilis*), which are common on all the islands of the archipelago.

Several of the younger men have reputations as wallaby spearers, but comparatively few animals, considering the numbers about, are taken, chiefly because easier sources of obtaining food are plentiful. Young men often practice, using low cycad palms as targets. They stealthily approach to within ten or fifteen yards, and hurl several spears on after another as fast as possible at the target.

Fighting Spears.

At least four types of fighting spears are found on the island: One-piece hardwood spears; hafted spears with barbed hardwood heads; bamboo-hafted spears; stone-headed spears. The first two are manufactured on the island; the other two are imported. Both the former are termed 'manjurata.' There are twenty or thirty recognized spear-makers on the island, and each has his own style of spear and ornamentation. In a bundle of over three hundred examples (obtained from the natives as fines for iron, wire, and other metal objects stolen by them), they could identify the maker of each. The spears are usually made in sets of from three to a dozen, and pains are taken to make all the spears of the set similar as regards length, weight, and ornamentation. Tests made by

Fig. 39. Men of Talakuropa. Fig. 40. Spear-throwing.

setting up a target (a drawing of a wallaby on bark, four feet in height) showed that the effective range of the spears was thirty yards. At thirty-five yards only one man hit the target at a height of more than a few inches above the ground, whereas at the former distance few failed to score a body hit. The text fig. 40 shows the natives who took part in the test. It will be noticed that the man engaged in throwing his spear, and at least two others, are left-handed; many other islanders are left-handed also.

The barbed one-piece hardwood spears are made from stringybark wood. Long strips of wood are split off the felled trunk of a tree and roughly trimmed

into shape in the bush. With a bundle of these an old man returns to camp, where younger men cut and scrape the spear-shafts and shape the head for the operation of cutting the barbs. For these purposes stone knives were employed up to the time of our visit, but were soon replaced by metal. It is certain that in former years some metal implements were received by them from the Macassar men, but more recently their absence caused an entire reversion to the use of the older implements. In pl. viii, fig. 40, is shown a spear ready for the process of barb-cutting. This operation is performed by the spear-makers themselves. The point is first shaped, and then about three inches from the apex the first barb is

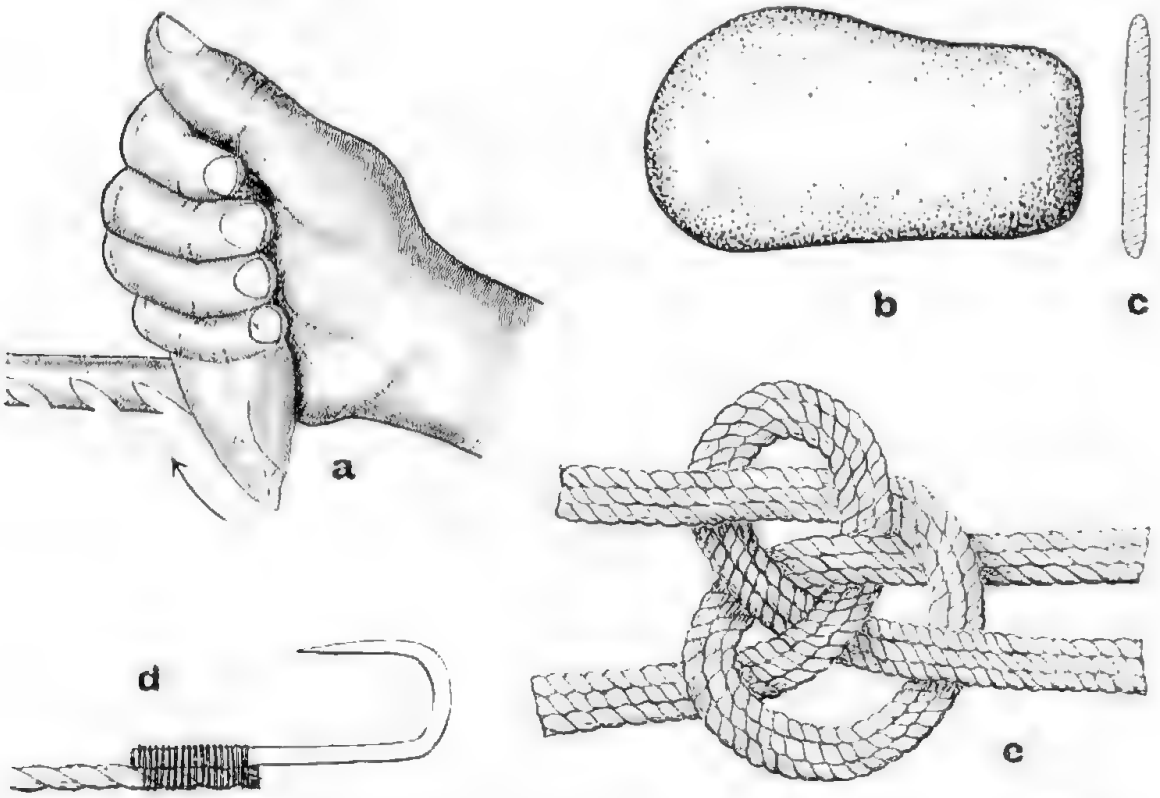


Fig. 41. a, Method of cutting barbs. b, c, Rubbing stone for body scars. d, Fish-hook. e, Knot employed in string belts.

fashioned by a series of small cuts. The knife is held in the postion shown in text fig. 41 (a), grasped in the palm of the hand, with the apex of the blade pointing down, and the back edge of the knife resting in the base of the palm. By moving the hand upward, pressing the edge of the knife on the work, and levering on the base of the palm, great and steady cutting power is obtained. After the barbs have been completed, and the surface scraped as smooth as possible, it is polished by rubbing with a smooth, hard pebble or a piece of ironwood. The spear is then trimmed to the correct length, and the depression formed in the end for the throwing-stick. Some spear-makers bind gummed

string around the spear, near the end, to prevent splitting. Any warping which may have taken place is remedied by heating the warped portion over a small fire and holding the spear in a counter bent position until cold; the point also is hardened by thorough heating.

The outline of the colour patterns is scratched on and the design filled in with the patterns of lines and dots usual among the Ingura.

Plate viii, figs. 33 to 41, show various spears of the one-piece type; fig. 37 being the other end of a spear belonging to the same set as that shown in fig. 38.

The second type is the hafted two-piece spear. In this the head is split from a piece of ironwood, and the barbs cut out while the wood is green, as it becomes tough on drying. The shaft may be cut from a piece of stringybark, or from white and softer wood. An U-shaped cut about two inches or more in length is made in the top of the shaft, and the head, trimmed to fit, is spliced in. Bloodwood resin is melted on to a piece of stick, over a small fire; it is then kneaded and pounded between two stones, warmed again until sticky, and smeared over the end of the spear, which is pressed into the cut in the shaft. The juncture is bound with string, resin is plastered over, and by spitting on it and working it with the fingers it forms a hard, smooth surface on cooling.

The average length of the spears is just over nine feet, including a barb about one foot six inches in length, and the average weight is about fifteen ounces. A few of the two-piece spears are very long and heavy. Those made by an old man named Papatama are over ten feet in length, including a barbed head three feet long; they weigh about nineteen ounces. A set of three was obtained, and the head of one of these is shown in pl. viii, fig. 46.

The usual form of barbing used in the fighting spears is produced by cutting a series of slanting ovate holes in the expanded side of the spear-head, thus forming a series of barbs joined together at their summits by a knife-edged strip of wood (see pl. viii, figs. 34, 42, etc.). In use the fine strip of wood often twists off, exposing the barbs beneath, and renders the spear difficult to remove: the islanders on the whole agreed that it was the best type of barb. Many of the spears have small, open barbs placed close together (see pl. viii, figs. 36, 46, etc.). The Ningubuyu people on the mainland employ large, long, and widely-spaced barbs, and a few of the Ingura spears approach this type (see pl. viii, figs. 44 and 45). Combinations of two or more of the above styles are commonly met with, and two are illustrated in pl. viii, figs. 33 and 35. In a style of barbing, said to be that of an old man of Bartalumbu, the barbs are arranged on both sides of the spear. The only example obtained is shown in pl. viii, fig. 41. To increase the difficulty of removing the spear by drawing it through the wound, some have one or more reversed barbs, as seen in pl. viii, figs. 36, 39, 41, and 45.

The manufacture of fighting spears of the above-mentioned types is almost confined to the island tribe, and all examples met with on the mainland among tribes as far removed as the Allawa and Mara, were identified as having been traded from tribe to tribe from the islanders. On removing the less carefully executed white paint patterns from barbed spears obtained from the Mara people at Roper River, traces of the finer patterns peculiar to the Ingura were discovered below, and on enquiry it was ascertained that the spears had been brought from the Nungubuyu country. Pl. viii, fig. 38, shows one of a set of six Ingura spears redecorated with a cruder Mara pattern of white. Pl. viii, fig. 37, shows the other extremity of another of the set, in which the end, for about a foot, has been painted white by the Mara, a feature not practised by the Ingura.

The older men are constantly employed in making spears, and produce great numbers; over three hundred spears were noticed in the possession of a party of about thirty men of Talakurupa. Canoes visiting the mainland take over bundles of spears for trading purposes, and emu plumes, red ochre, and stone (quartzite) implements are received in exchange.

Bamboo-shafted spears are occasionally used by the Ingura. They are most favoured by the Balamumu tribe of Caledon Bay, by whom they are manufactured and traded to the adjacent tribes. They are crudely fashioned in comparison with the straight, polished spears of the islanders, each consisting of a stick (*Acacia*) from two to five feet long, sharpened at one end, and with several notched rings cut at intervals along its length; to this a shaft, formed of a length of light bamboo, is fixed with string and gum (see pl. viii, fig. 50). Such are usually about eight feet in length and very light (three and a half to seven ounces).

Despite their apparent inferiority, these spears are, in the hands of the Balamumu, more feared than any others along the coast. This tribe is constantly at enmity with the Ingura, and during the period of our stay on the island two raids were made by their young men, led by older ones, against the islanders. On both occasions they were driven off, but not on the first occasion before they had visited our camp and stolen wire and other metal objects. Flinders had trouble with members of this tribe at Caledon Bay in 1803; a party of trepangers were attacked there also in 1916, and several were killed. A Japanese pearling party were attacked at a bay south of Cape Grey in 1923. The vessel was plundered, two of the Japanese being killed and several wounded.

Specimens of the bamboo-shafted spear are occasionally possessed by the Ingura men, who can throw them well. Being light, they travel further than their own heavy spears, which, however, are preferred for fighting in scrub or forest country, as they are not so readily diverted by contact with the undergrowth. In addition to their long range, the bamboo spears have the advantage

of lightness, enabling a large number to be carried, and further, if the spear misses its objective, it generally, on striking the ground, breaks near the junction of the acacia stick and the bamboo, whereas the hardwood spears, being stronger, can usually be picked up and thrown back. Thus the hardwood spear users are at a disadvantage, and as it is often the number of spears that count, there is much to be said for the cruder weapon. Each of the twenty-six young men in the first of the raiding parties referred to above had from fifteen to forty spears in his possession.

No stone suitable for implements is found on the island, and manufactured knives and spear-heads are obtained by trade from the Nunguhuyu, who receive them in turn from natives of the interior. All the stone implements found on Groote Eylandt have at one time or another passed in turn through the hands of the Allawa, Ngalakan, Mara, and Nunguhuyu, the former obtaining them from tribes still further south. Owing to their scarcity, stone-headed spears are much prized, and the natives could not be induced to part with them except for metal equivalents. Many are crudely shafted, and have come from some inland tribe, in whose territory crooked saplings, roughly straightened in the fire, only are available. In other cases the stone has been reshafted with a straight length of stringybark or white wood.

Pl. viii, fig. 51, shows a stone-headed spear obtained on the island from the men of Talakurupa. It has a crooked shaft, bearing the colour pattern common to the Mara. Its thin end is painted white, as already described. Pl. viii, fig. 52, shows another stone-headed spear from the island; its crooked shaft has been replaced by one of stringybark; the blade is protected by a wrapping of paper-bark and string. Some years ago a trepanger discarded a mild steel water-tank on an island in the Gulf. It was cut up by the natives of the locality, and several pieces were obtained by the Ingura, who ground them to a characteristic spear-blade shape and attached them to shafts in a similar manner to the stone heads.

Throwing-sticks.

At least three types of throwing-stick are in use among the Ingura. These are: (a) 'yumangala'; (b) 'yukarupu'; and (c) 'manuntunga.'

The 'yumangala,' or flat throwing-stick, is generally cut from soft wood. It is somewhat rectangular in section, with the head or peg-end slightly tapered. The peg is attached on the flat side, and is formed of a piece of ironwood or pine *(Callitris)* about an inch and a half long, evenly tapered at each end. It is secured with string and bloodwood gum into a notch cut in the head of the stick; it may be strengthened with a thin strip of cane, as shown in pl. ix, fig. 57. The head and the handle, which latter is indicated by a notch or by a raised band of wood, are often painted white, and the shaft red-ochred (see pl. ix, figs. 53 and 57). At times patterns in white and yellow are worked over the red (pl. ix,

fig. 58). Many are simply red-ochred all over, as in the ones shown in pl. ix, figs. 54 and 55. The toy (pl. ix, fig. 56) was picked up near a women's camp.

The 'yukarupu' are circular in section, and generally cut from hardwood. They are similar in form to those of the tribes south of the Roper River, but the bunch of human hair string there used at the extremity of the handle is replaced by a binding of fibre-string. One example of stringybark is figured in pl. ix, fig. 59. It is the type most frequently met with on the island.

The 'mamuntunga,' a type with an enlarged handle, is peculiar to the island. It is generally made from the wood of the cypress-pine *(Callistris)*. The head and shaft are similar to those of the 'yukarupu,' but the end is expanded and flattened into a lanceolate handle, divided from the shaft by a raised ring of wood, as is often found in the 'yumangala.' Usually throwers of this type are profusely decorated with patterns in red, white, yellow, and black. Examples are shown in pl. ix, figs. 60 to 69, and 71, but the camera has failed to show the yellow and red designs in detail. In some examples the pattern is first cut in the wood, giving an etched appearance (pl. ix, figs. 60, 61, 63). In pl. ix, fig. 70, is shown an example on which a design has been scratched only. Usually the shafts are left unornamented or are merely red-ochred, but others are decorated, as in pl. ix, figs. 61, 66, and 67.

In use the 'yumangala' and 'mamuntunga' are held above the junction of the handle with the shaft, and thus the handle is purely conventional. In the 'yukarupu' the grip is close to the end.

Clubs and Boomerangs.

Clubs are not used by the Ingura, who know them only by name (mabarukwu). The Nungubuyu, who occasionally acquire them from the Mara, call them 'mabaruko' or 'mariri.' By variations of these names they are known to other tribes of Arnhem Land. The Mara use them for parrying the boomerang in their encounters with tribes living to the southward. The Ingura despise them because they are used by women of many mainland tribes, in conjunction with yam-sticks, for camp quarrels.

The boomerang, which they call 'aribina,' derived from their word 'aripa' to throw, is known to them only from exaggerated rumours of their wonderful killing power. The nearest tribe in which the boomerang is used for fighting is the Allawa. On showing boomerangs to Talakurupa men they became frightened, and on striking a throwing attitude, they fled in terror.

Clothing and Ornament.

The chief articles of clothing are a 'mapini' or pubic tassel, and a belt. The 'mapini' is generally made from long pandanus fibres, teased-out bark fibre, or the fur of the wallaby, native cat, and other animals. When fur is used it is

prepared by spinning with the fingers into a two-stranded yarn. A quantity of the yarn is formed into two parcels, each about eighteen inches long, tied round the middle and connected by a loop, which is passed over the belt, and appears like a single tassel. That shown in pl. x, fig. 75, is composed of bark fibre. 'Mapini' are first worn by boys after the first initiation ceremony. Most of the younger men but few of the older ones wear them.

Another type, of more ample proportions, is made with all the strands woven together at the base. It has a definite loop for attaching to the belt, and is worn only by women. An example of red-ochred fur is illustrated in pl. x, fig. 76.

Belts are worn by all the natives. They are of various types; several are common among all the tribes of the Gulf, but others appear to be restricted to the islanders. They may be conveniently dealt with under the following headings: (a) Hair belts; (b) Fur belts; and (c) String belts.

Hair belts, called 'abalumukwu,' are made from human hair string in several ways. The simplest is by winding the string round and round the body; the thicker the belt the better, and as occasion offers more string is added. When taking off such a belt the string is wound around the tassel, so as to form a compact parcel, as shown in pl. x, fig. 77. This form is troublesome to unwind, and to form a more convenient belt the hair-string is often coiled into a larger ring on the ground, bound in two opposite places, pulled taut, and wrapped around the body, the two tied places being joined by a piece of string, and the junction concealed by the loop of the pubic tassel (see pl. x, fig. 75).

Fur belts are manufactured from fur string in a similar manner, the soft fur of the flying opossum being favoured.

String-belts (ilempi) of several styles are probably peculiar to the island, the occasional example seen elsewhere having been traded.

One type is made of an open string work, so knotted together at intervals that flat discs of closely woven string are formed. Three or more strands of string are used, and the principal knot is shown diagrammatically in text fig. 41 (c). These discs may be small and arranged in a double row, forming a narrow belt, as illustrated in pl. x, fig. 74, or they may be large and distributed in a triangular pattern, forming a wide belt, as in pl. x, fig. 72. In another type, made also by the Nungubuyu people, the string is closely woven to form a flat belt about an inch wide. An example is shown in pl. x, fig. 73. In both the above-mentioned types the fastening of the belt about the body is provided for by a loop at one end and a loose end of string, or a permanent knot or button, at the other, the button being passed through the loop to hold the belt in position.

The belts are usually decorated in colour. In the flat, disc-bearing type the open string-work is painted white, and the discs picked out with red and yellow

The closely-woven belts are generally ornamented with transverse bars of several colours.

The average length of the belts is about thirty inches, and they are worn so tightly round the abdomen as to cause a marked constriction.

No other clothing is ordinarily worn. Large sheets of paperbark are used as rain shields, being wrapped about the body when walking or used as a shelter, the native crouching or lying down under the protection. They are, however, abandoned on arrival at camp or on cessation of the rain, and are never used as wraps or blankets.

The women sometimes wear a 'mapini' as described above, and, according to Mrs. Dyer, wear a bark wrapper in the presence of strangers. It is made of several large pieces of stringybark, hinged in either three or four sections, each of which is about eighteen inches wide, and of such height that having folded the laterally-hinged wrapper about the body it can be held under the arms so as to clear the ground. It is apparently an exaggerated form of the short two-piece bark apron worn by Nungubuyu women in the presence of strangers.

An ornament worn on the back, and supported by a loop of string around the neck, is shown in pl. x, fig. 78. It consists of strands of string painted alternately in sections, red and white, with tufts of lorikeet feathers dividing each section.

Armlets of various kinds are worn by men, women, and children. They are often worn on both arms, but when there is possibility of fighting, all are placed on one arm, so as to leave the spear-arm unencumbered. Armlets are often exchanged as signs of friendship, and thus become widely distributed. Three types may be recognized: Cane armlets, or 'yurudo'; string and fur armlets, or 'mieji,'; and feather armlets, or 'mujija.'

The 'yurudo' are made either from long strips of cane, or more frequently of the midrib of pandanus leaves. In their manufacture a double ring of the material is made, and another strip is woven through it until a close pattern is built up. In the final stages an ironwood awl, six inches in length, is forced between the meshes to make a passage for the strip. The awl is lubricated by rubbing the point on the nose. Pl. xi, figs. 86 and 87, show armlets of pandanus fibre, and pl. xi, fig. 88, one of cane. When coloured the designs consist of transverse bars of several colours.

'Mieji' are made by binding string or hair-string round a loop of cane or grass, fastening in pieces of animal fur during the process. Twenty or thirty are often worn on one arm; those shown in pl. xi, fig. 85, were all worn on a native's left arm.

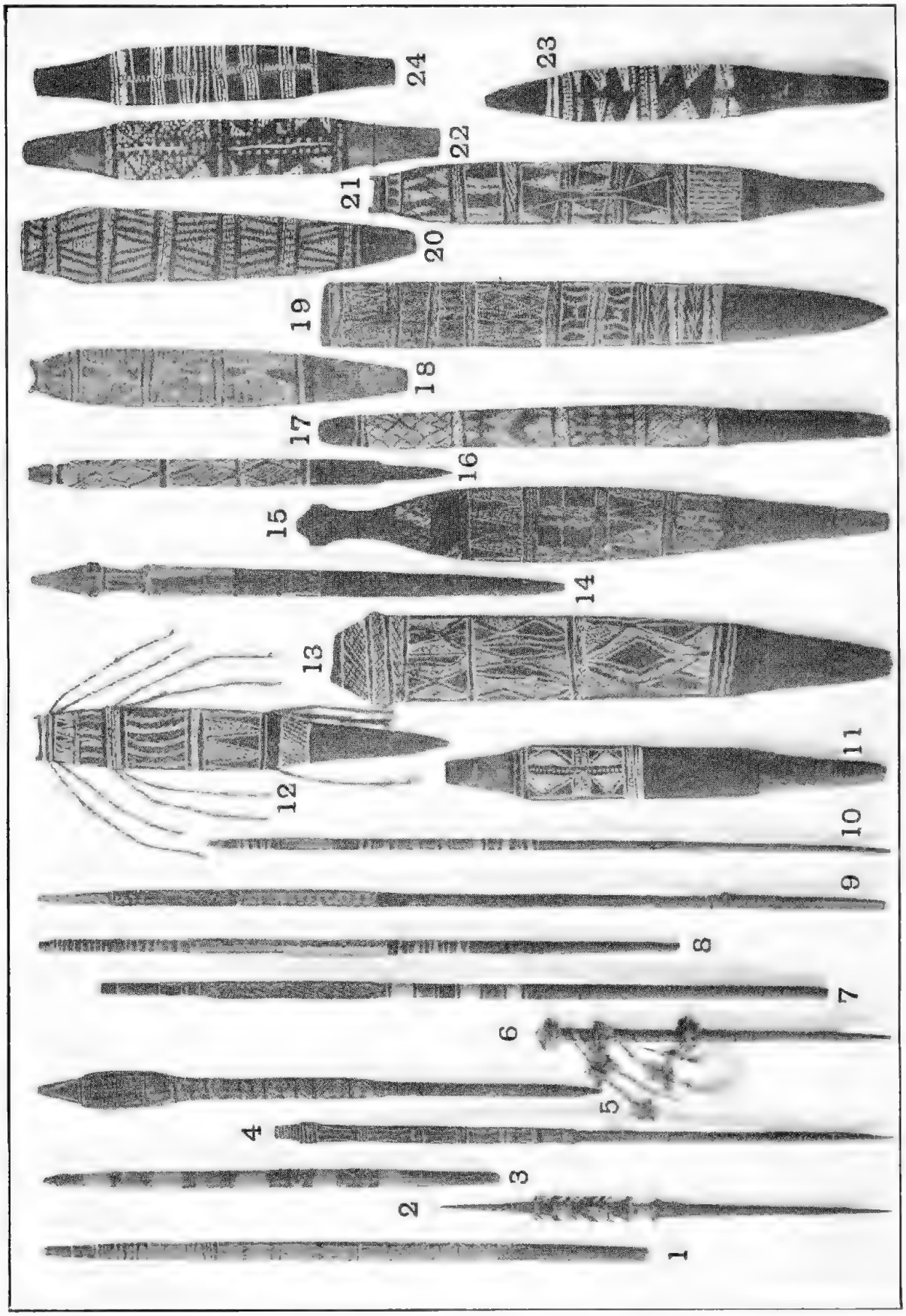
'Mujija,' or feather armlets, are made in similar manner, the bright feathers of birds, such as the lorikeet *(Trichoglossus rubritorquis)* being substituted for

the fur. Pl. xi, figs. 81 to 84, shows such armlets. In pl. xi, fig. 81, the feathers are bound in an erect position, while in fig. 82 they are more or less adpressed. The streamer is a solid feather cord. In pl. xi, fig. 83, the feathers are reversed, and project outwards; a tuft of white feathers is gummed to the end of the streamer. Pl. xi, fig. 84, shows a child's armlet similar to that in pl. xi, fig. 81.

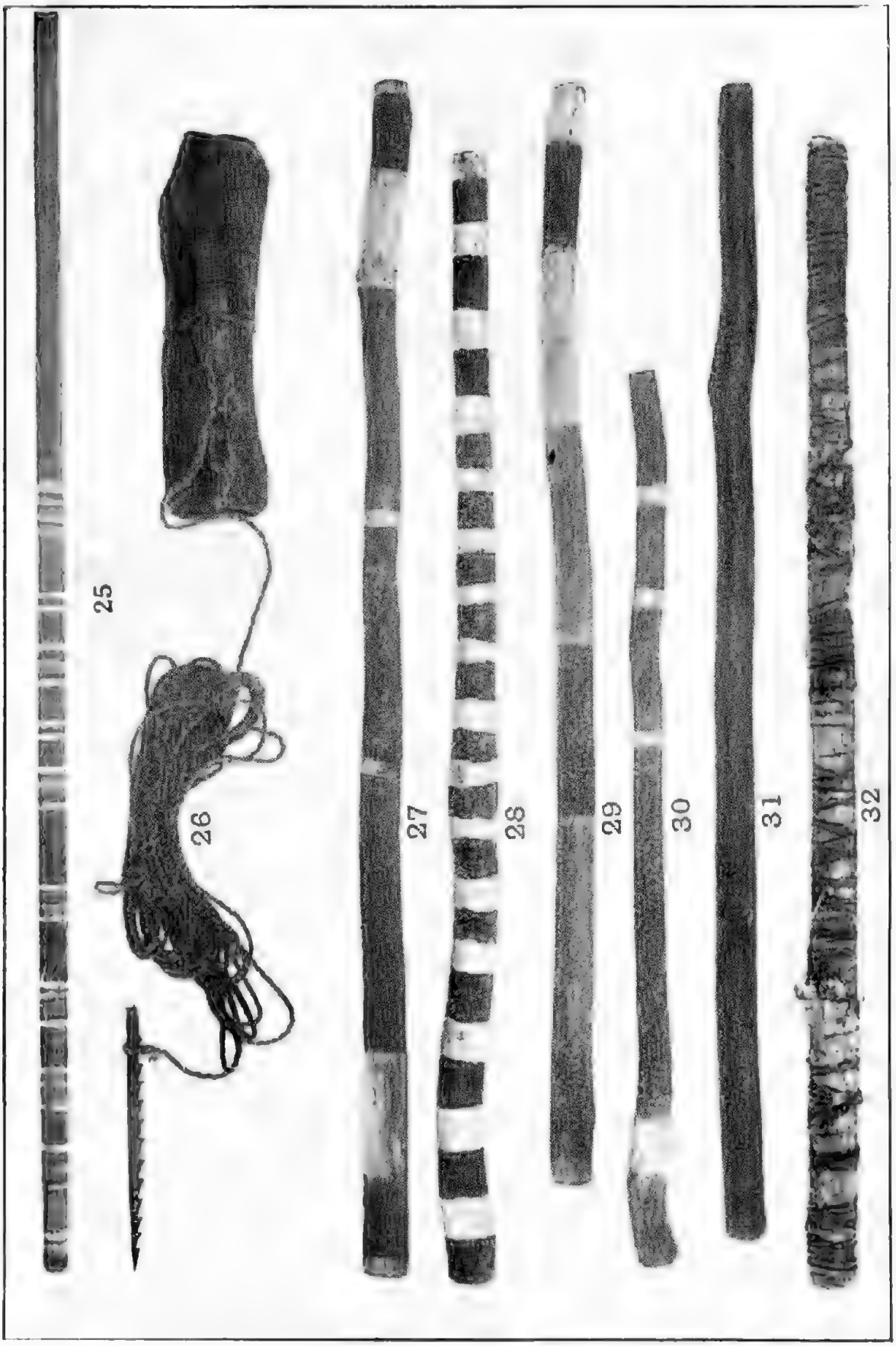
Many natives have their noses pierced, without special ceremony, some time after the Unamalia-maindi operation. A plain stick, half an inch or more in diameter and three inches long, is thrust into the hole made in the septum, and retained until it heals; afterwards the hole is gradually distended to the required dimensions. A small, woven cane or wooden ring smeared with wax is forced into the aperture, and is wholly concealed within the septum; the nose is thus given a decided tilt, and the nostrils become prominent.

A plain white nose-stick can be thrust through the ring, and is used as an ornament. Often natives do not have the nose pierced, and some who have do not keep the aperture distended. Nose-piercing is more common among the Balamumu to the north than in the southern tribes, such as the Mara. Pl. xi, figs. 93 to 96, show examples of the cane nose-rings, made in a similar manner to the cane armlets. That in pl. xi, fig. 95, is coated with wax, and was obtained from a Bartalumbu man named Ningbijiga. Pl. xi, figs. 89 to 92, illustrate examples of wooden nose-rings cut from the hollow stem of a shrub (*Morinda citrifolia*).

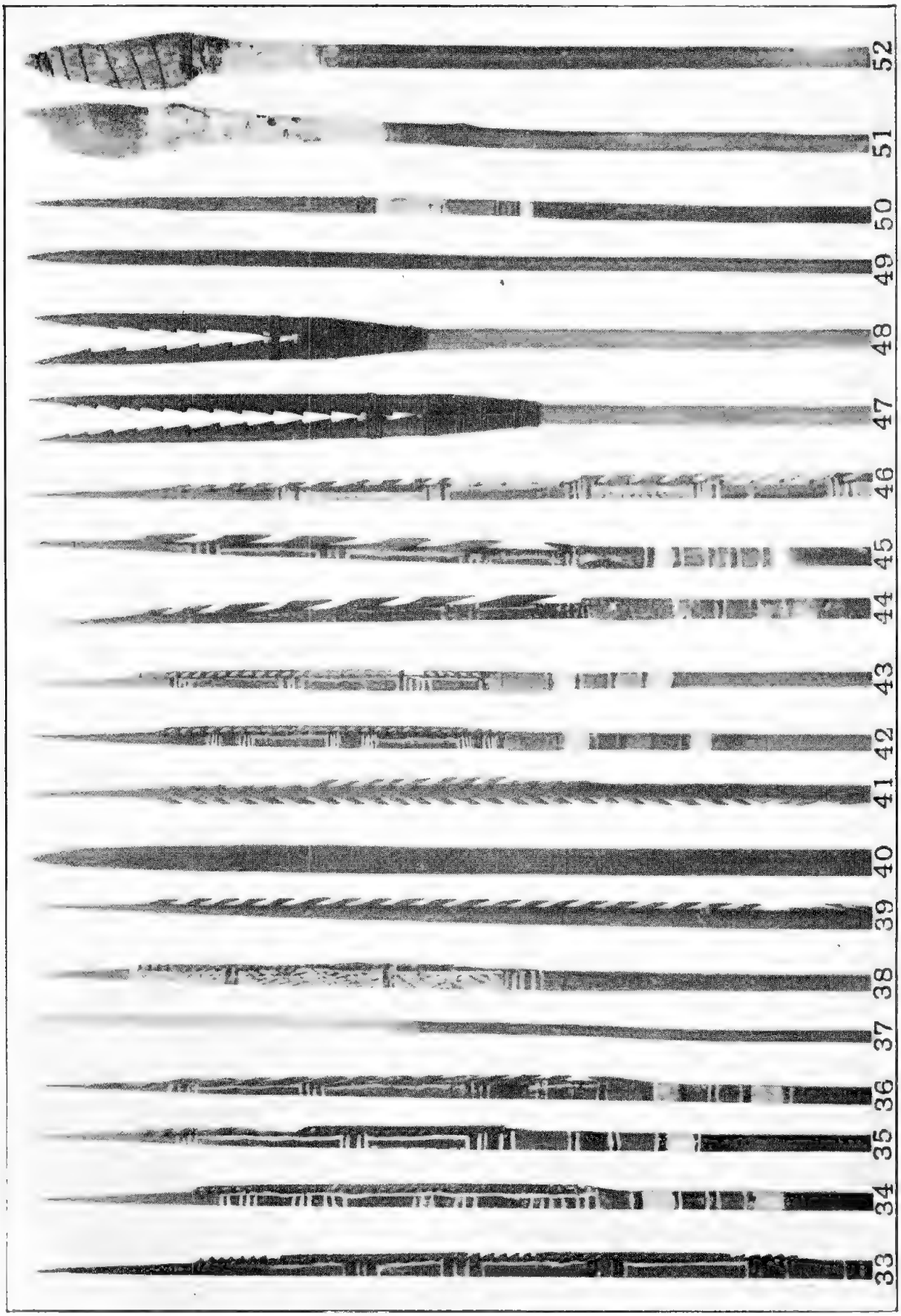
Middle-aged men have their noses red-ochred; this is a luxury, for ochre is rare, and obtainable only from the interior. The continual use of the substance as a cosmetic gives their skin a coarse, pitted appearance. Teeth are not removed for ceremonial or ornamental purposes, as is practised by some of the mainland tribes.



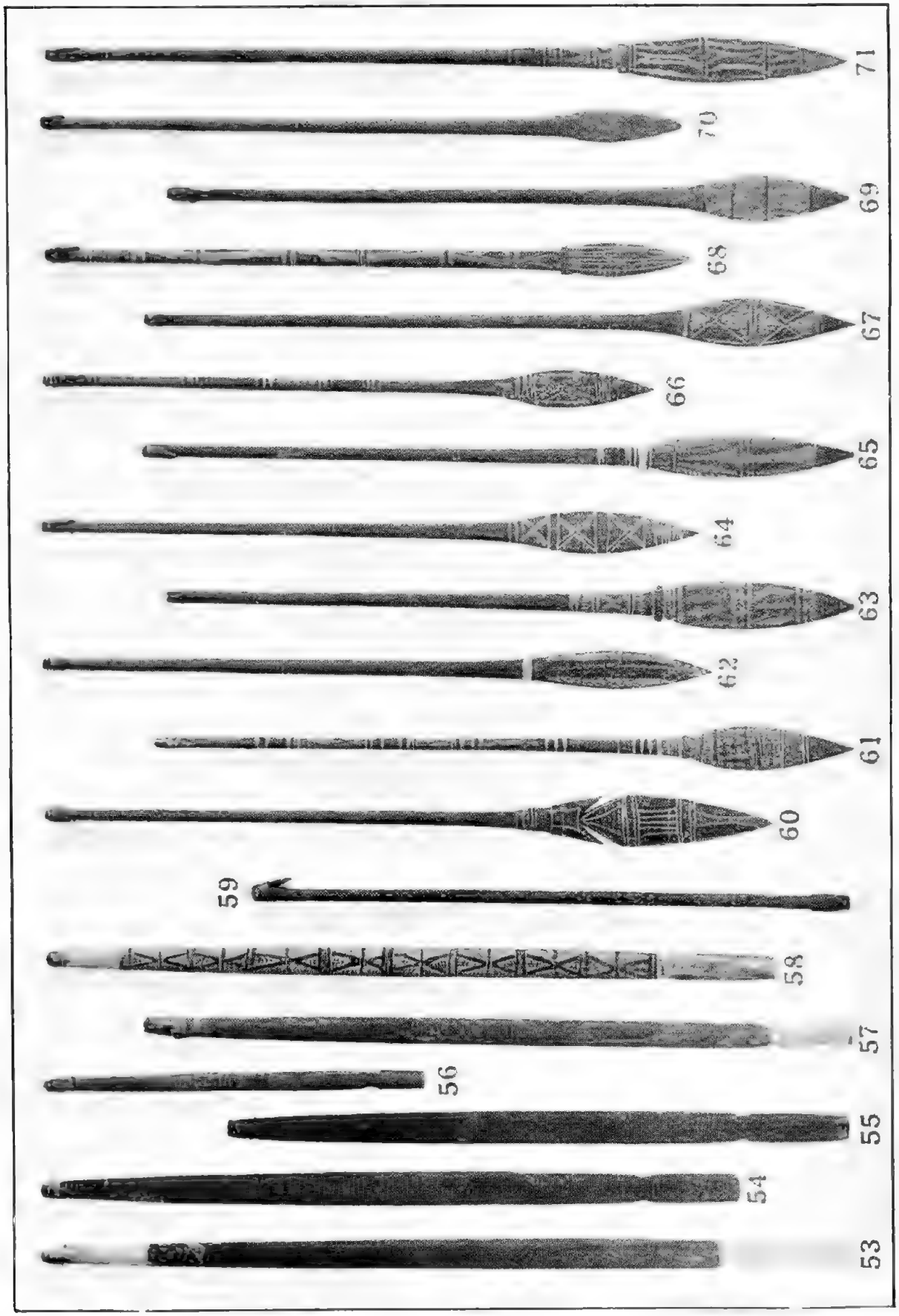
DANCING STAVES, MINIATURE CEREMONIAL OBJECTS, AND CORROBBOREE STICKS, GROOTE EYLANDT.



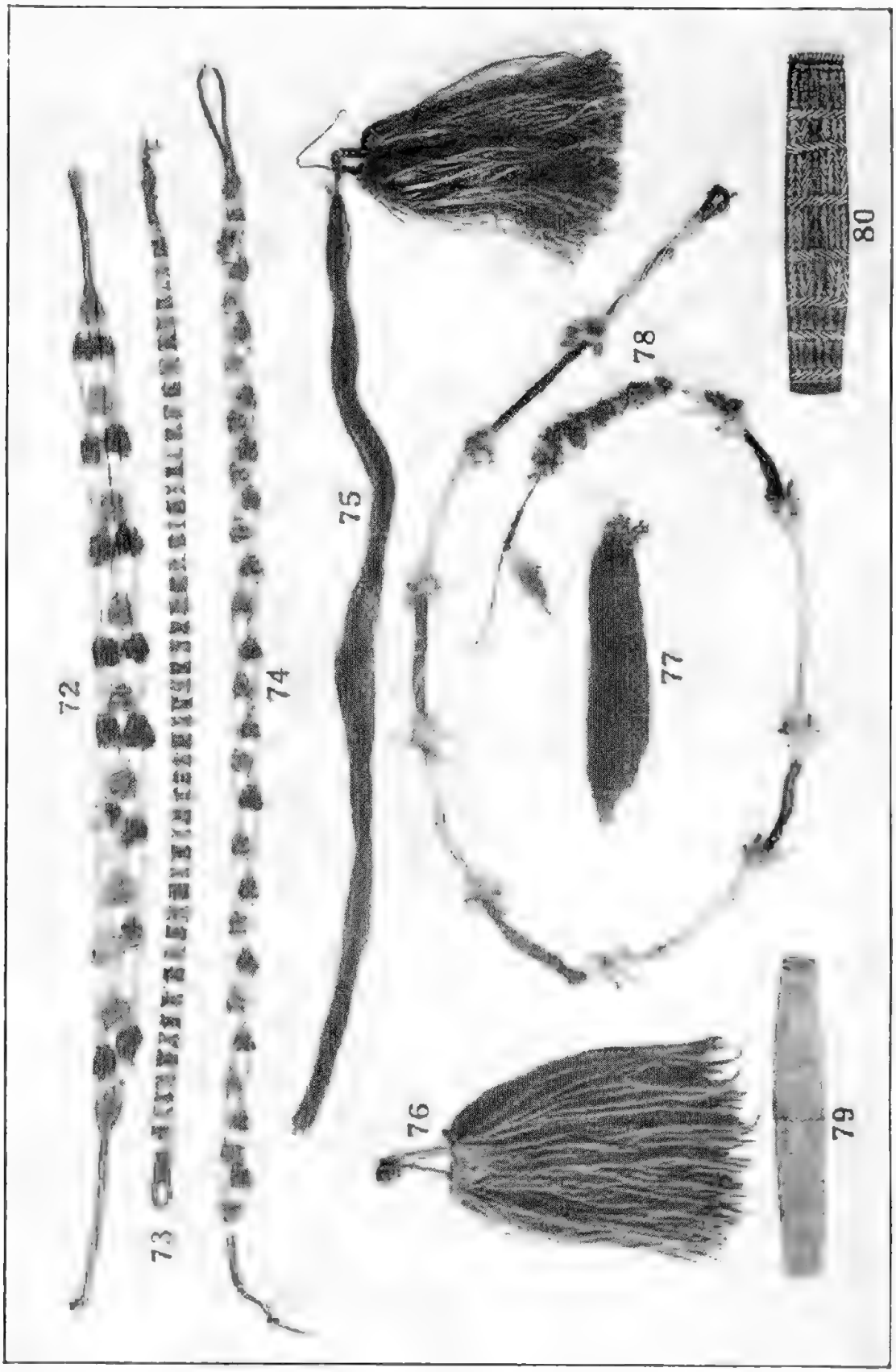
DUGONG HARPOON AND DRONE PIPES, GROOTE EYLANDT



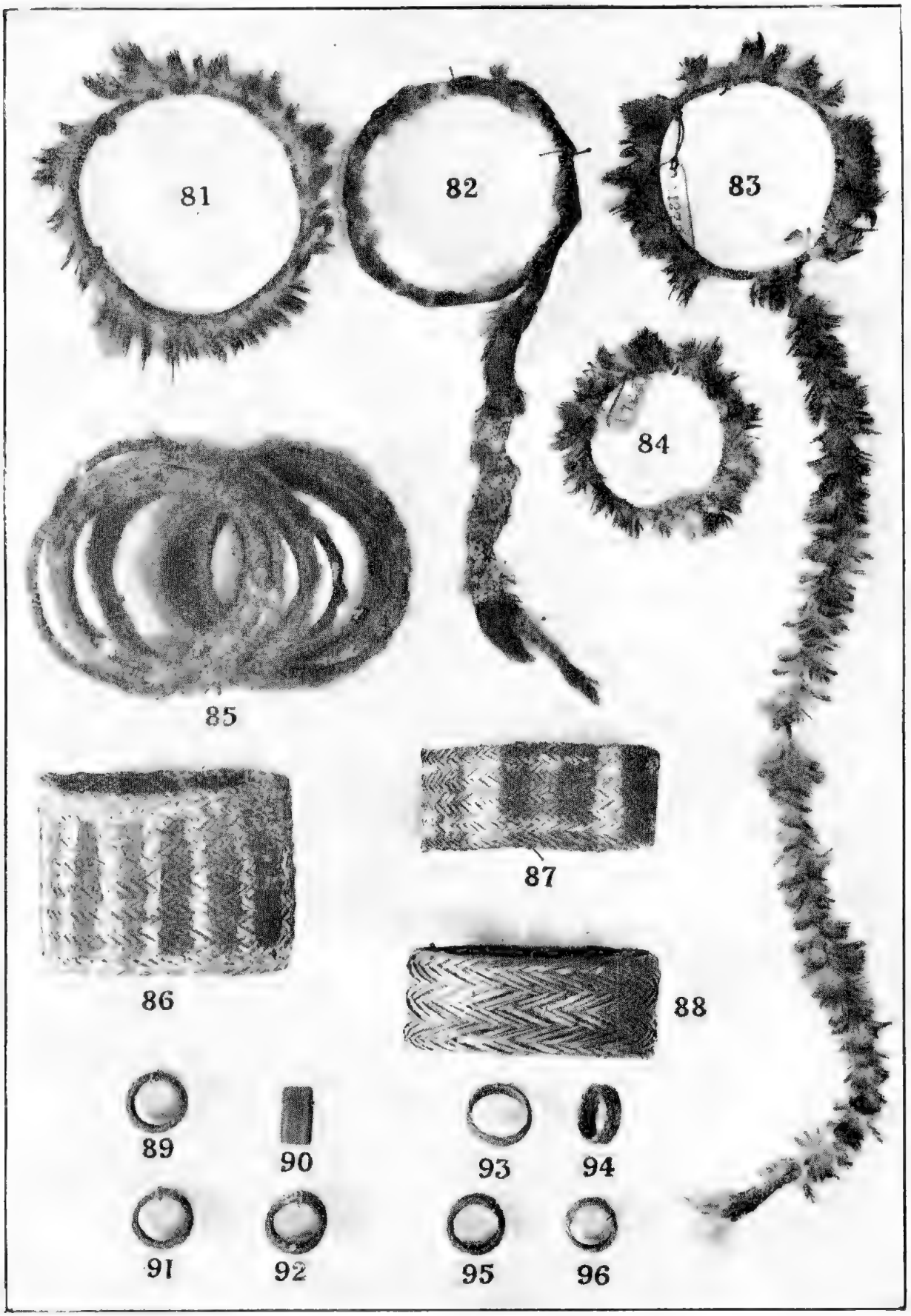
SPEARS, GROOTE EYLANDT.



THROWING STICKS, GROOTE EYLANDT.



BELTS, TASSELS, AND MESSAGE STICKS, GROOTE EYLANDT.



ARMLETS AND NOSE-RINGS, GROOTE EYLANDT.

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NATIVES OF GROOTE EYLANDT AND OF THE WEST COAST OF THE GULF OF CARPENTARIA PART II

BY NORMAN B. TINDALE, ASSISTANT ENTOMOLOGIST, SOUTH AUSTRALIAN MUSEUM

Summary

Flinders mentions that after an encounter with some natives at Woodah Island he picked up their canoe, and writes: "The canoe was of bark, but not of one piece, as at Port Jackson; it consisted of two pieces, sewed together lengthwise, with the seam on one side; the two ends were also sewed up, and made tight with gum. Along each gunwale was lashed a small pole; and these were spanned together in five places, with creeping vine, to preserve the shape and to strengthen the canoe. Its length was thirteen and a half and the breadth two and a half feet; and it seemed capable of carrying six people".

NATIVES OF GROOTE EYLANDT AND OF THE WEST COAST OF THE GULF OF CARPENTARIA.

By NORMAN B. TINDALE, Assistant Entomologist, South Australian Museum.

PART II.

Plate xii and text figs. 42-65.

INGURA TRIBE.

Canoes.

Flinders ([13]) mentions that after an encounter with some natives at Woodah Island he picked up their canoe, and writes: "The canoe was of bark, but not of one piece, as at Port Jackson; it consisted of two pieces, sewed together lengthwise, with the seam on one side; the two ends were also sewed up, and made tight with gum. Along each gunwale was lashed a small pole; and these were spanned together in five places, with creeping vine, to preserve the shape and to strengthen the canoe. Its length was thirteen and a half and the breadth two and a half feet; and it seemed capable of carrying six people".

One or two canoes of this kind are said to be in use along the adjacent mainland, but only in sheltered creeks and bays. The material utilized is peeled from the stringy-bark tree *(Eucalyptus tetradonta)*, the fibre lashings being hibiscus. Natives of Talakurupa showed me the methods employed in making such a canoe. Two rings are cut at a distance of twelve or fifteen feet apart, and joined with a single longitudinal cut. The bark is then hammered with stones until it becomes detached from the tree. This is only possible during the wet season. The long sheet of bark naturally forms a cylinder. It is held over a fire and thoroughly heated, the dry, ragged outer bark being partially burnt off. When sufficiently hot the bark is laid inner side downward, on smooth ground, and kept flat with rocks, logs, or heaps of sand. After several days the outer loose ragged bark is peeled off, and the sheet is ready for canoe-making. The bark is never turned inside out in use; the natives were greatly amused when I made a canoe for my own use with the smooth side of the bark outside.

The two principal types of canoe are dugouts, and are both called 'leva-leva'. They are cut from large trees, including Leichhardt pine *(Sarcocephalus cordatus)*, paperbarks *(Melaleuca)*, figs *(Ficus glomerata)*, and several others which have soft wood. These are found growing in dense jungles near the sea on the western side of the island and at Wendanga on the mainland.

([13]) Flinders, M., Voyage to Terra Australis, ii, 1814, p. 198.

The shore-canoe is generally small, about twelve or fourteen feet long and eighteen inches wide, and is capable of seating three or four persons. Bow and stern are always recognized as such, but they differ little in size or shape. The sides of the canoe are supported by transversely placed sticks, which are wedged in place but are not fixed or lashed. The shore-canoe is commonly met with along the coast of the Gulf, north of Spillen Creek, among the Mara, Nungubuyu, Ingura, Balanumu, and Tchambarupi. The bow and stern are usually vertical, but an example in the possession of an old man at Makalaoba had the bow cut in a sloping manner, as shown in fig. 54c.

The sea-canoe, which is a development of the shore type, is found principally among the Ingura and Nungubuyu peoples. It is generally more elaborately fashioned and of larger size. A fine example was over twenty-five feet long and two feet nine inches wide. It was capable of seating from eight to twelve persons. In the widest portion two could sit side by side with ease. An inferior example (seventeen feet long and two feet wide) was secured for the collection after a larger one (nineteen feet long and two feet three inches wide) had been stolen from me by natives from the north. The latter example is illustrated in fig. 50, which shows the positions of the seats and of the mast.

The prow in the sea-canoes is much larger than the stern, is often very long, wide above, and tapered to a knife-edge at the waterline. The transverse supports rest on projections left on the sides of the canoe, and serve as seats; provision is also made by a hole in one of these for the stepping of the mast (balyara). Sails (tumbala) and paddles (miaja) are used, a specially long paddle serving as steering oar when sailing. The canoe is ballasted with several blocks of stone, a strong rope attached to one of them and to the base of the mast or the seat near the bows, serving as an anchor (amora). A block of coral with a hole through it is sometimes used instead, this being partially wrapped with paper-bark to prevent its sharp edges cutting the line. A fire is generally carried on a hearth amidships, either on a stone or on earth resting on several thicknesses of paper- or stringybark. Paper bark is used to form comfortable cushions, several thicknesses being laid on the seat. This bark is also used to caulk cracks and leaks in the hull; the bilge-water is baled out either with a large shell (*Cymbium diadema*) baler or a bark dish.

In making a canoe, the tree is felled in the forest or swamp with a metal tomahawk obtained formerly from the Malays, and roughly shaped and hollowed out on the spot. Fig. 42 shows an old canoe abandoned in the forest at Yetiba at this stage of manufacture. Suitable trees are not very plentiful; all are well known, and regarded as the common property of the section of the tribe within whose boundaries they are growing. Natives would not, without consultation

with the old men of the local group, dare to remove them. Machapmunyi (Talakurupa) showed me a large tree *(Melaleuca)* on the banks of the Yetiba, about two miles north of the main stream (which is properly called Awarikpa), which he said would make a fine canoe. Should he desire to so use it the permission of Nanamopura (Yetiba) would be necessary. The merits and possibilities of

Fig. 42. Old hollowed log at Yetiba. Fig. 43. Chipping inside of canoe.

certain big trees are often discussed around the camp-fires, and when passing near them detours are frequently made to examine them afresh; the men anxiously tapping them with a stone or stick to ascertain if they were becoming hollow; for trees decayed or hollow internally are useless for canoes; many very large trees seen bear scars, indicating that attempts to fell them at some time in the past have ceased, on meeting with indications of decay. The process of hollowing out a canoe is known to the Ingura by the words 'oratea levaleva,' literally "cut out the canoe," but the word 'oratea' is not used in any other connection.

Aninguliwunta, a Bartalumbu man, one of the principal canoe-makers, wished to make a big sailing canoe, but owing to a quarrel with men of the Nungubuyu tribe he was unwilling to go to Wendanga, on the mainland, and ask for a large tree. He therefore felled one at Angoroko, which was rather small, and suitable only for a shore-canoe. The principal operations in connection

with the making of this canoe were witnessed. The process is similar to that employed in the case of the sailing canoes, although certain refinements are not carried out. Much attention is paid so as to obtain as great a beam as possible. The initial excavation is therefore rather restricted in width, and widened as the depth increases (see fig. 54 a). When the log is hollow the sides can be forced and held apart by transversely placed sticks. The canoe is then carried or dragged to the water and floated to the camping ground. In the case witnessed it was paddled along the shore for a distance of fully ten miles to Yetiba, by means of temporary paddles split from a branch of the canoe-tree. The careful chipping required to make the sides of uniform thickness of about one inch is carried out in camp (figs. 43 and 44). The thickness is judged by tapping with a stick or stone, or by placing the palms of the hands together with the sides of the canoe between them, and moving them about over the place to be tested. The thickness at the bows and stern is much greater, depending on the nature and grain of the wood. The principal difficulties occur where the grain has to be cut across. There is no keel, but the bottom of the canoe is finished with a thickness, especially in the sailing canoes, of over three inches. After final chipping the canoe is placed in the water, tested for balance, and then, with three or four inches of water in the bottom, placed on a long heap of dried leaves and twigs made ready on the bank. The heap is then set on fire (fig. 45), and the outside soon becomes charred and dry; while the heat is so great that the water in the canoe finally boils (figs. 46 and 47). The canoe meanwhile is rocked from side to side, so that the interior is continually bathed with hot water. Should the flames take too great a hold on any particular place they are beaten out with sticks. When sufficiently burnt, and the interior properly steamed, the water is spilled out on the fire (fig. 48), and the canoe removed. The sides are quickly forced widely apart and held in position by slabs of wood previously prepared (fig. 54 b). The hull is then rubbed with pieces of wood and bunches of twigs to remove the loose charred wood, leaving the exterior black and smooth.

No special ceremonies mark the cutting out or launching of canoes, but journeys are frequently made soon after to show them off to neighbouring peoples.

No ornamental carving is done on the canoe. There is often a hole in the prow, through which the anchor rope is occasionally passed, but more often it is without use. It is bored with a knife and a burning stick. Sometimes the prow and stern above the waterline are brilliantly red-ochred; when this is done the effect against the black hull is very striking.

In the sailing canoe the transverse supports or seats rest on projections left on the sides, to which they are lashed, if loose; the mast is stepped through one of them, and its base either fixed in a hole in the centre of a solid block left

Fig. 44. Chipping keel of canoe. Fig. 45. Setting fire to canoe. Fig. 46. Burning the canoe.
Fig. 47. Replenishing the fire.

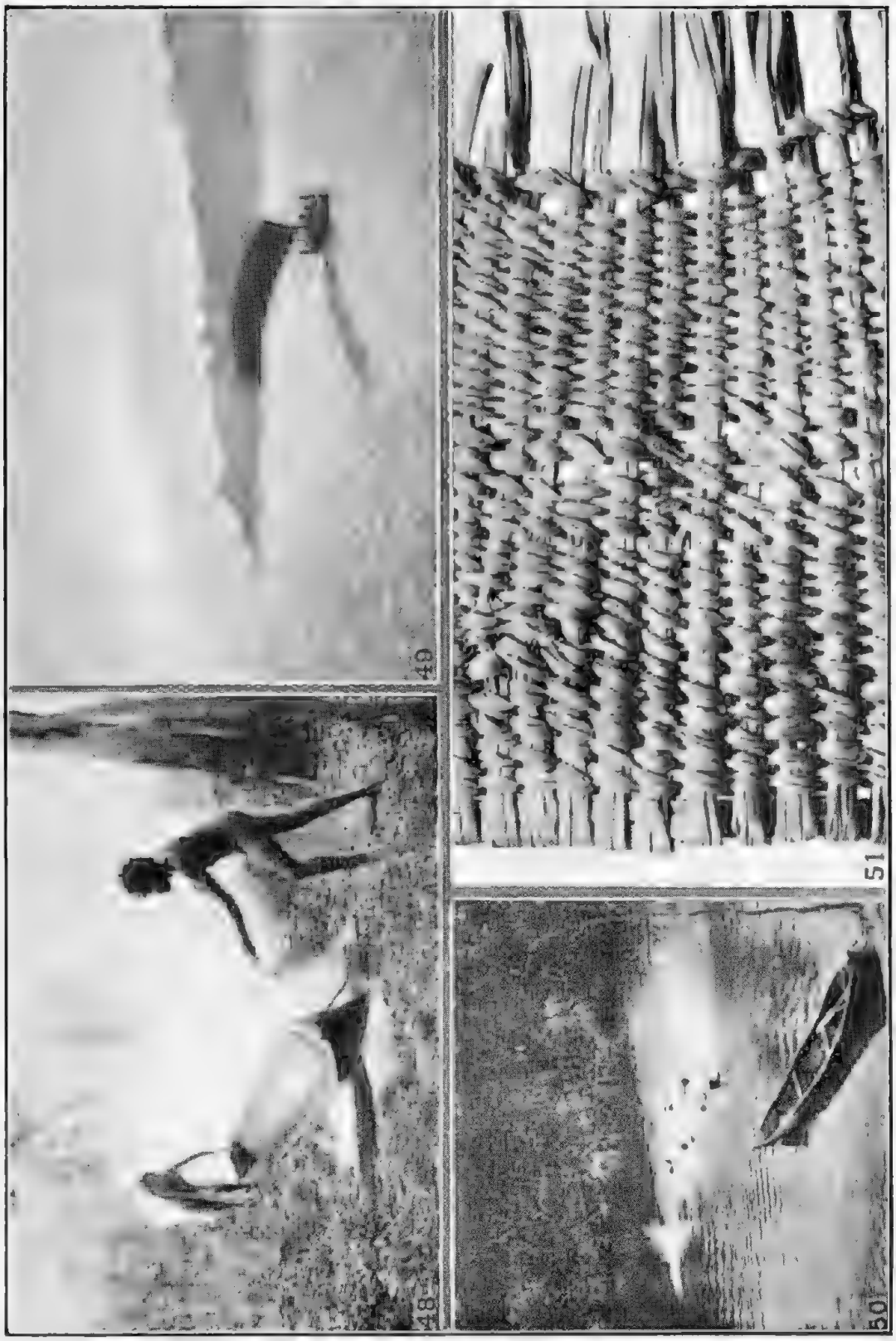


Fig. 48. Emptying out the boiling water. Fig. 49. Canoe sailing before the wind.
Fig. 50. Swimmers and canoe at Yetiba. Fig. 51. Portion of mat-sail.

on the floor of the canoe, or simply in a hole in the floor (fig. 54 b). The mast is a round pole of some strong wood, such as that of the rose apple *(Eugenia)*, from six to eight feet long, with a deep V-shaped notch, or a hole, cut in the head in place of a pulley. In none of the canoes seen was there any standing-rigging for the support of the mast.

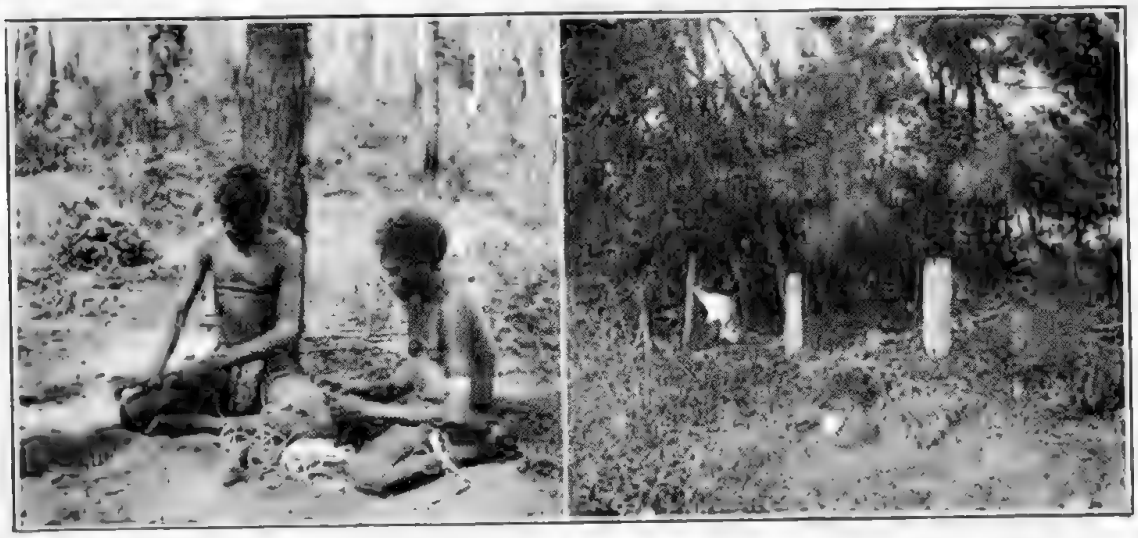


Fig. 52. Making cord for rigging. Fig. 53. Graves of three Malays at Winchilsea Island.

The sail (tumbala) is from twelve to seventeen feet wide and about three feet high, supported between two long, slender spars, each from fourteen to eighteen feet long (fig. 54 d). A halliard is attached to the yard at a distance of roughly one-third from the throat; it passes through the notch or hole in the mast-head, and is made fast to the mast behind the foot of the mast. The tack of the sail is hauled down and secured by a length of rope to the seat in front of the mast. There are usually five ropes attached to the boom at intervals along the posterior two-thirds, serving as sheets. The first is attached loosely to the mast: the second and third are tied together, and their common extremity is itself tied to the fourth. The fifth, attached near the clew, is free. The free ends of the fourth and fifth sheets are held in the hands, or they may be fixed to the seats if the breeze is gentle and steady (see fig. 54 d).

The sail is woven from the light, flattened stems of a reed-like plant found in the swamps on the island. Fig. 51 shows a portion of an unfinished one in the collection. It is lashed to the spars with hibiscus cord. Supported in the manner described above, it assumes the characteristic position shown in the figures.

In sailing a close-hauled course cannot be held, but advantage is taken of a quarter wind. Moderate seas can be encountered without swamping; should this

happen the canoe is easily righted in the manner described on page 79. The natives swim well in any sea, using a modified double overarm stroke when on the surface and a form of "dog-paddle" when swimming below. (Several are shown practising the former stroke in the background of fig. 50). Often the ballast of the canoe would be lost, but little else. The ballast is shifted from side to side to trim the canoe when sailing, and the natives lean to windward, in the manner of yachtsmen. In reversing direction the sail is lowered, the canoe turned by paddling, and the sail rehoisted on the other side of the mast. The steering paddle is not fixed to the canoe, but held free against the lee-side with both hands of the steersman.

The rate of paddling is not usually greater than three knots, even on short spurts. With the ketch moving before a light breeze at nearly four knots, parties of men in canoes were unable to keep up for more than a few moments. However, with the ketch doing nearly six knots on a steady three-quarter wind off-shore, the canoe shown in fig. 49 overtook and passed us with ease, maintaining a speed well over seven knots.

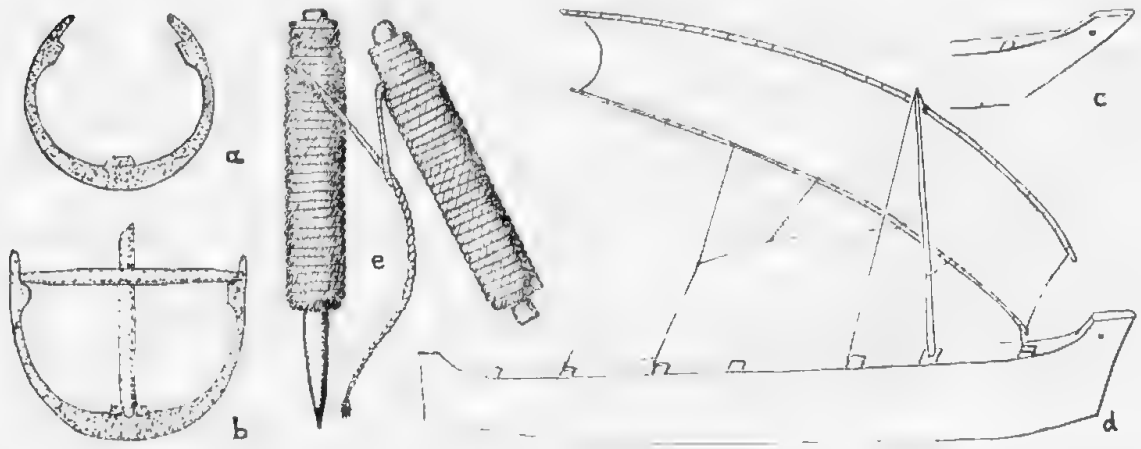


Fig. 54. a, Section of unfinished canoe; b, same, after fire-treatment, showing method of stepping mast; c, prow of canoe at Makalaoba; d, canoe, twenty feet long, showing rigging; e, anchor-line in course of manufacture.

There are probably more than twenty-five big sailing canoes in the possession of the islanders. In two days, around Bickerton Island we saw six; the first day two put off from Burney's Island, and two more under sail from Bickerton.

Children are early taught to take an interest in canoes, models being made for those of six and seven years of age. Some of them are highly ornamental, but being made from soft bottlebrush wood *(Banksia dentata)* soon fall to pieces. For larger children wooden canoes six or seven feet long are made, in which they paddle about along the shore and in the creeks. Both these types are represented in the collection.

The seafaring habits of the Nungubuyu and the Ingura are well developed, although it is noticeable that the natives of the eastern side of the island do not possess many large sailing canoes, and spend less time on the sea. The men of Bartalumbu and some Nungubuyu have a splendid knowledge of direction when at sea. Three of them (two Ingura and a Nungubuyu), making their first voyage on a European vessel, were tested under various conditions. After several days' absence from land, in a direction S.E. from the island, they were able to give the direction of six places within the bounds of their knowledge, five of them (Numburuwa, Makalaoba, Yetiba, Amakulu, and Cape Beatrice) correct to within 12½°, and one (Roper River) with somewhat less accuracy. The experiment was repeated on another occasion at night-time, during a calm, with practically the same results. The area of which they have knowledge extends from Caledon Bay and Cape Arnhem in the north, to the mouth of the Roper River in the south, and as far east as the sandbanks off the North-East Isles, east from Groote Eylandt.

A story was told me by a Bartalumbu man of a party of natives who at some indefinite time in the past ventured eastward in a sailing canoe. They met with sandbanks, where there were many birds-eggs to be had, but although they went a long way further east, and found great numbers of turtles and sea-snakes, they saw no land.

All the various islands to the north of Groote Eylandt are visited in rotation in search of turtles' and sea-birds' eggs; the latter especially being found in great numbers at the beginning of the wet season.

The chief voyages made by the islanders are along the shores, but they venture out of sight of land in going to Numburuwa on the mainland and to Caledon Bay in the north, making direct voyages of about thirty miles. They avoid extended night travel except when the moon is full; but, nevertheless, hunt for dugongs on dark nights, if the sea is calm and phosphorescent.

Between the island and the mainland the tides run north and south, sometimes exceeding five knots per hour, and the natives take full advantage of the currents on their voyages from place to place.

The following phrases and words are used in connection with sailing canoes. The English renderings are literal:

magigumi amora	pull up anchor
urinaga baiyupeiyu	haul the rope
urinalararia tumbala	hoist sail
urinaraga tumbala	lower sail
urinungundi yuka tumbala	roll up sail
wadamaigina levaleva	bail out canoe
madayina levaleva	paddle the canoe
yaimena	to swim
mungulupa amora	lower anchor

The four points of the compass have names. The Nungubuyu names are: N., 'umbiala'; S., 'wakianga'; E., ramalila'; W., 'alkalila.'

Paddles.

The occupants of a canoe, from one to ten in number, each wield a narrow-bladed paddle (from three feet six inches to four feet six inches in length), except the one at the prow, who usually has a much longer paddle, from five to six feet six inches in length.

Pl. xii, figs. 97-105, shows nine figures of both forms of paddles. Some of them have been freshly decorated; most old paddles bear signs of former colour designs, washed off by immersion, except where the grease and dirt from the hands have somewhat protected the colours. The design is often permanently scratched on the paddle before painting, and can be thus renewed on occasion. The principal wood used for paddles is the cypress pine *(Callitris)*, the slabs of wood required being split from the base of the living tree.

In paddling several strokes are made alternatively on each side. The top of the paddle rests in the palm of one hand; the lower end is grasped between fingers and thumb of the other. The motion is given by the lower arm, the upper hand, which is held at arm's length, constituting the pivot. The paddle is thrust in the water ahead and slightly out from the side of the canoe, and pulled rapidly backward with a slight semicircular motion; it is withdrawn from the water at the end of the stroke. A fresh hold is taken during the change from side to side. No regularity is usually kept, some paddling on one side and some on the other. The efforts of the steersman, who when not sailing uses a small paddle, are chiefly confined to rapid lateral strokes, but despite his endeavours the haphazard paddling results in a zig-zag course.

In reconnoitring, or moving slowly and watching for turtles or fish, the man in the prow stands upright, and uses long, slow strokes of the big paddle, while the others remain quiet. When preparing to spear dugongs, turtles, or fish, he is armed with a harpoon or spear, and the man at the stern is the only one who paddles. If a man is alone in a canoe he sits at the stern and paddles, in which case the forward part of the canoe for two or three feet is out of the water; if proceeding leisurely or hunting, he stands in the bows.

The old men, who often do not take part in the paddling, sit in the waist of the canoe, near the fire-hearth. The paddlers either sit on the bark-cushioned seats or kneel on the bottom of the canoe. The steersman seats himself in a reclining position on a wad of paperbark thrust between the sternmost seat and the stern, with his legs hanging over the seat into the body of the canoe.

Camps.

The nomadic bush- and sea-faring life of the islander prevents the construction of permanent dwellings, and the camp as a rule is merely a cleared sandy area, chosen at a distance of about a hundred yards from water or at the back of the beach, with a breakwind about two feet high, formed by placing sticks slantwise in the ground and laying sheets of bark on them. Behind this low barricade, which in a large camp may be thirty yards long, shallow holes are scooped in the sand six feet or so apart, and each native occupies one of these depressions, lying at right angles to the breakwind, with only his head protected by it. Between each sleeper, and at each end of the line, small fires are kept burning, stores of firewood sufficient for the night being piled up in several heaps near at hand.

During the wet season, when food is plentiful and travel uncomfortable, owing to the moist heat and cold rain, huts are built and occupied for several weeks or months at a time. They are usually long, low shelters of bark, supported on a framework of poles, and built to shelter from one to thirty or more persons. The height of the roof-tree is about four feet, and the side-frames are about three feet high (see fig. 56). A large hut would be ten feet wide and thirty feet long. The bark covering is partly stringy- and partly paper-bark. Sheets of the former, three feet wide and about fourteen feet long, are laid over the framework of forked posts and poles, and the whole then covered with irregular sheets of paperbark, held down with sticks and logs. One half of the hut is often left open at the sides, and used as a shelter during intervals between the rain; the rest is used for sleeping. Small fires are kept burning at intervals between the sleepers, who lie across the hut alternately head to right and left, with their feet along the middle of the hut. At each end acrid smoke fires, formed of the green, volatile leaves of the ironwood *(Erythrophlaeum)*, are lit whenever mosquitoes or sandflies are about. A wall of earth or sand is built around the hut, the inside of which is generally below the level of the ground, owing to the scooped-out sleeping depressions. The rain sometimes washes away these walls, and floods out the occupants of the hut. When the ground is wet the natives lay poles on the floor, cover them with bark sheets, and lie upon them, but this floor is removed as soon as the ground is dry again.

The floor of the hut is sometimes spread thickly with clean yellow sand from the river's bank, brought up in bark dishes by small boys. The sanitary conveniences are small, deep holes, covered by a piece of bark or stone, which, for protection against magical interference by other members of the tribe, are often dug in the shelter of the hut. Scattered about the interior of the hut are stones for grinding colours, shell and bark dishes, throwing-sticks, and drone-pipes;

Fig. 55. Temporary camp near Yetiba. Fig. 56. Small abandoned wet-season hut. Fig. 57. Camp scene; with piles of wood-scrapings from spears. Fig. 58. Wet-season hut for thirty persons.

bundles of spears are supported under the roof. The smooth bark walls of the hut in course of time become covered with sketches, drawings and painted designs executed during the idle hours of the day. The small old abandoned hut near Amakuhi, shown in text fig. 56, had many such pictures, some of which can be seen on the right wall. The wet season is a time of industry. Many spears are made, weapons, baskets, and ornaments are painted, and ceremonial objects are prepared. In text fig. 57 unfinished spears are seen lying about, with piles of scrapings and shavings.

Caves and rock-shelters at Makalaoba, Chasm Island, Bartalumbu, and East Bay are made use of during the wet season, and the walls of these caves are also covered with pictures. Not all caves are so used; some are reserved for the disposal of the bones of the dead, and after the final burial ceremonies are avoided.

The vicinity of the camp soon becomes foul with rotting fish, bones, and other rubbish; the dogs act as scavengers, while crows come in great numbers to clean up the deserted camp.

The huts on the ceremonial ground at Amalipa (see p. 84) differ from those above mentioned in their greater height and usually their less substantial construction, although one large ruined hut had a framework of very substantial poles.

String and Rope.

In emergency, and as a temporary measure, lengths of bark are knotted together to form string and rope for various purposes, but the usual practice is to use two-ply worked strings and ropes made principally from the fibre of *Hibiscus tiliaceus*. This is peeled from the inner side of the bark in white strips, half an inch wide, and several feet long, and formed by teasing and tearing into long fibres. In text fig. 52 the man on the right is seen to be teasing the fibre for his companion.

The simplest way of forming the string is by rolling on the thigh. In this method the two operations of forming two strands of twine and of twisting them into a two-ply cord are carried out simultaneously. The man on the left in fig. 52 is thus making cord.

The principal method, whether for cords or ropes, is more complicated. In the first step a sharpened stake about two feet in length is placed upright in the ground in front of the operator, who makes a short preliminary length of single-ply twist, which he attaches to the stick. On the end of this piece he then proceeds to make further lengths, twisting the fibres in clockwise direction very tightly between the thumb and forefinger of the left hand, straightening the loose fibre ends meanwhile with his right hand. New pieces of fibre are added with the right hand, as required, and when a foot or two of twine has been

completed he lifts the stake and places it in the ground further away from him. When three or four feet of twist has been prepared he rolls the stick on his thighs, winding the twist very tightly on to it. He repeats the process, and when he has prepared a sufficient length, or the stake is full, he prepares another similar one, from which he finally chops off the pointed end. The two sticks of twine then appear as in fig. 54 e.

In the second step he places the pointed stake in the ground, and taking the ends of the strands from both sticks of twine in one hand, and the truncated stake in the other, he twists the two strands together, holding the completed two-ply rope in one hand and revolving the stake around the twist from the other stake in clockwise direction. The completed rope may be up to half an inch in diameter; it is of great strength when properly made, but perishes on long exposure to salt water. It is almost invariably twisted clockwise, but there is one old fishing line in the collection which was made in the reverse direction. Great quantities of rope and cord are used by the natives, and the men, who alone make them, are often seen so employed in the camps.

In the manufacture of human hair-string for hair-belts (abalumukwu) a spindle is used. This is a shaft, to one end of which is bound a piece of stick to form a hook. The hair is dragged out from the mass of raw material with the hook, and is twisted by revolving the spindle on the thigh. For details of the spindle shown in fig. 64 g I am indebted to Mr. E. C. H. Lonsada.

Pictorial Art.

The islanders use and have names for four pigments, namely, red, yellow, white, and black. Abstract names for colours are not in general use. Three of the pigments, white, a form of kaolin called 'tongura,' yellow, a limonite called 'otarak,' and black, are found locally. The kaolin overlies the limonite in deposits cut by the Yetiba Creek, while the black pigment, called 'udumach,' occurs as an ill-defined mixture of manganese oxide and clay, known as wad, in a small deposit near Angoroko.

The red pigment, a haematite, called 'maruwura,' is obtained by trade from the interior of Arnhem Land. It is found in several different shades and in both granular and amorphous forms. The deposits are in the country of the Rembarunga, who gather and pass it on to various other tribes; by them it is known as 'merawongi,' a name very similar to the Ingura one; it is therefore curious that the intervening tribe, the Nungubuyu, through whose hands the material passes, should call it by an entirely different name, 'loni.' The traded article is much valued on the island, and extensively used in colouring utensils, weapons, ceremonial objects, canoes, apparel, ornaments, and persons. Considerable inducement was necessary to obtain it.

The pigments are powdered by rubbing on a stone. The white is then mixed with water in a dish, formed of a shell *(Unio)* or piece of bark; the other colours being mixed on the rubbing-stone. The starchy liquid obtained by rubbing the fleshy stems of various tree-orchids *(Dendrobium)* is often used instead of water, and gives adhesive qualities to the colour. Brushes are either pieces of stick about two inches long, chewed and softened at one end, short pieces of bark, or more usually pieces of feather an inch long with a handle of the same length formed of gum or wax.

Two or more colours are often superimposed or mixed together, giving various special effects. All articles to be painted are usually given a ground coat of either red, black, or yellow, after which the design is painted on in the desired colours. Red and white mixed are used to give a pink tinge, and a bright salmon colour results from using red, yellow, and white in certain proportions. The paddle shown in pl. xii, fig. 102, is painted with this salmon-red colour.

The designs painted on the various objects and weapons illustrated are in most cases built up of dots and straight lines, with occasional circles and other geometric combinations. There are no recollections among the natives questioned as to the significance of the geometric designs, which might be supposed to have a zoo- or phyto-morphic origin. It is true, however, that well-defined animal pictures are sometimes incorporated as the central objects of some designs. Examples of these may be seen in fig. 64 a and b.

The tracing of designs and pictures on the ground is a common pastime at night around the camp-fires. One or another traces (yinganar, to draw) with the fingers representations of animals, birds, fish, and reptiles. The various tracks made by animals and birds are also cleverly imitated; the tracks or foot-prints of their mates are also commonly depicted, the characteristic features and peculiarities of each being drawn in an exaggerated fashion, causing much amusement. Hunting and fishing episodes are roughly sketched, the artist meanwhile narrating the story of the happenings he depicts.

In similar fashion illustrations are painted in colours in an enduring form on the walls and roofs of rock-shelters during the enforced leisure hours of the wet season. Not only are paintings done in the rock-shelters, but any bark hut which has been occupied for some time contains such pictures.

The Ingura cave and hut paintings are chiefly those relating to sailing canoes, dugongs, turtles, fishes, parties of human figures, and hunting scenes. Representations of mythical beings and ceremonial figures, extensively depicted in mainland caves, like the one at Wagundu (Allawa tribe), are not seen on the island.

Flinders [14] saw some paintings on the walls of caverns under the cliffs

(14) Flinders, M., *l.c.*, ii, 1814, p. 189.

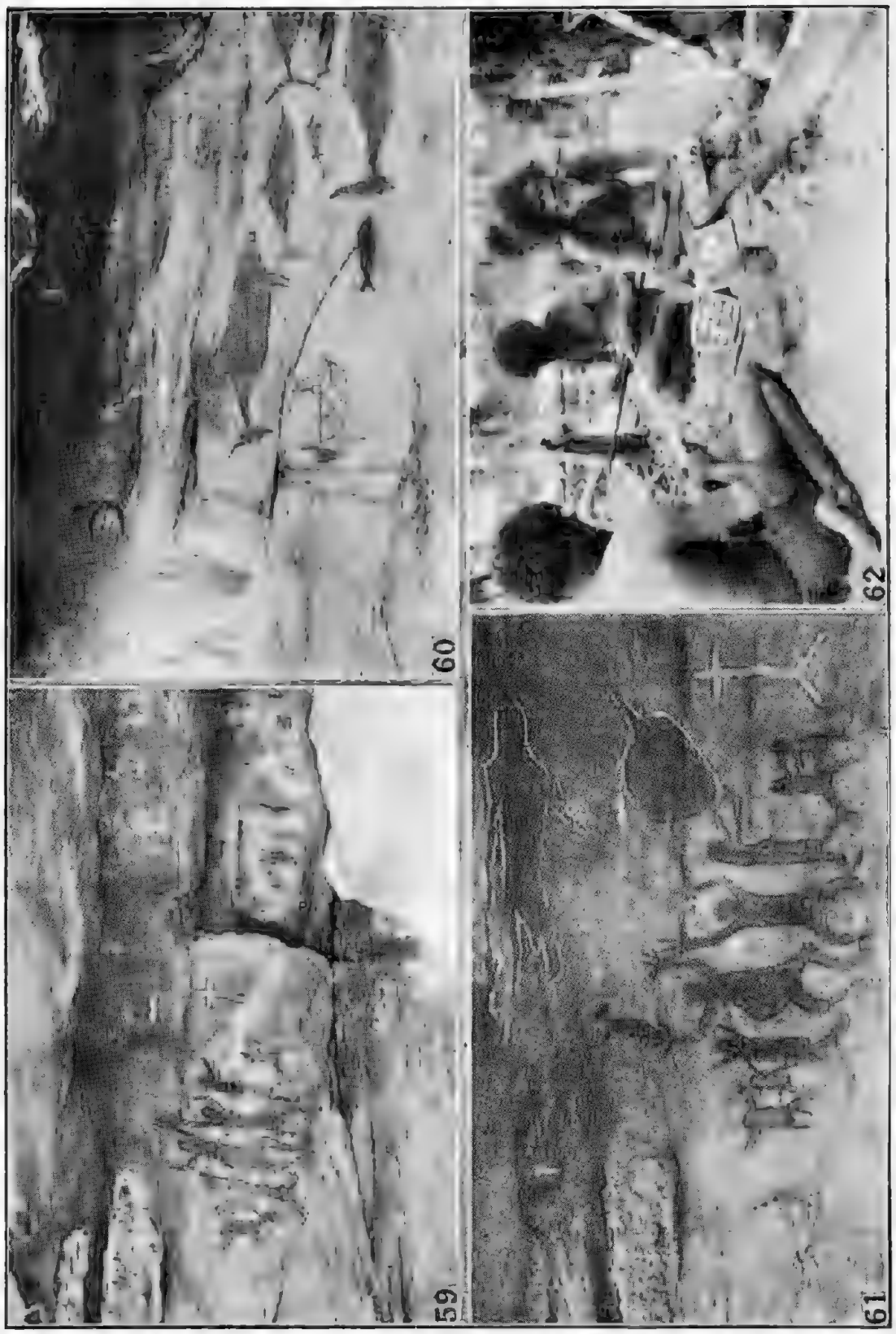


Fig. 59. Cave paintings at East Bay (see map, p. 65). Fig. 60. Cave paintings; hunting scene. Fig. 61, Enlarged view of human figures in Fig. 59. Fig. 62, Men painting weapons and bark.

at Chasm Island. According to the Rev. H. E. Warren the same figures are still there. Towards the lower end of East Bay (see fig. 24), at about the middle of the south-eastern arm of the island, there is a line of cliffs some distance inland, at the bases of which there are numerous low rock-shelters, hollowed out by the sea. On the walls of these shelters there are many paintings. A few were photographed, and others on the ceilings were traced.

Fig. 59 shows on the left a party of women and children; the central figure may be that of a white man, from whom the others are fleeing. On the right are several hands, made by coating the rock with red ochre, and then using the hand as a stencil, marking around it with kaolin. A stingray and a dugong are also shown.

Fig. 60 shows portion of a scene where numbers of dugong and other marine vertebrates are being pursued by three natives in a canoe. A man at the stern is paddling, another is sitting in the bow, while the third, standing just behind him, is throwing a spear with a throwing-stick, at what appears to be a fish, which is wounded and transfixed by another spear, which trails behind it.

In fig. 61 a portion of fig. 59 is shown from another direction, showing one of the women holding up a stingray, and the other, what appears to be an animal. Above them is the somewhat faded figure of a man drawn on a large scale. Many other faded ochre figures the camera failed to show with certainty.

Some of the tracings are reproduced on a smaller scale (approximately one-eighth natural size) in fig 63 (a to p); a represents a man in the act of spearing a native companion; b is a native dog, painted in white, with only one eye shown, in red; c is a wallaby. In d a man is spearing a stingray in company with a child; e shows a man in a dancing attitude; f and g are of two species of ray, the former the eagle ray *(Aetobatus australis)*, and the latter the fiddler ray *(Trygonorrhina fasciata)*. In one the eyes are indicated in red, in the other only one eye is present; the former has the much-prized internal fat-bodies indicated. H is the figure of a porpoise painted in white. The outline of a sailing canoe (i) was painted on a well-protected vertical rock-face in a place away from other paintings, and appeared to be of considerable age; it is reproduced about one-twelfth of the real size. J, k, l, m, n, and o were found associated, and apparently all painted by the same person; several of them are of doubtful significance, but l is a native companion and n is a turtle. P represents a long-necked tortoise, called 'imoraga.'

Language.

In writing the native words the Royal Geographical Society's system has been followed. The double vowels occur in all possible combinations, and the

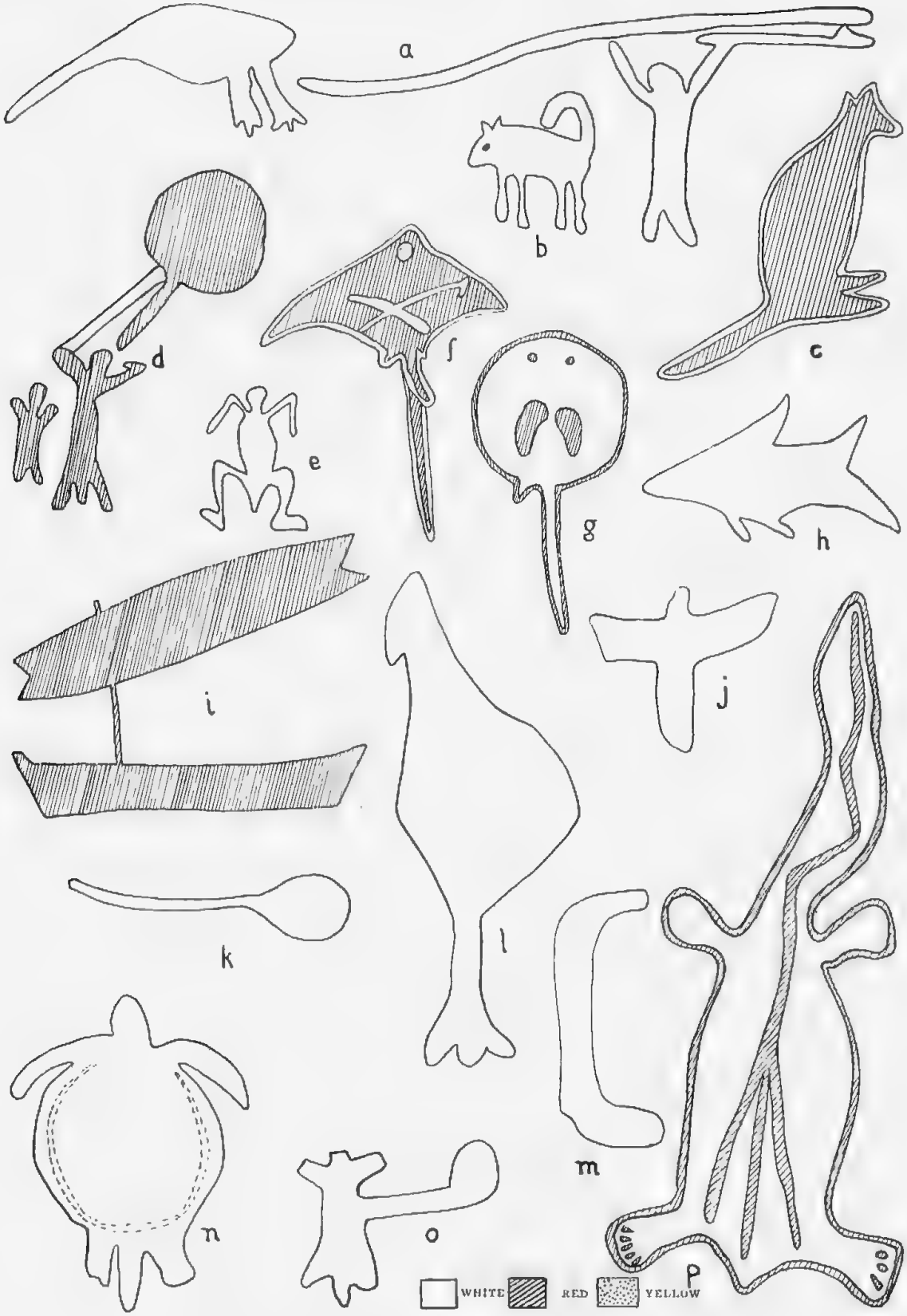


Fig. 63. Tracings of paintings (x ⅛ approx.).

following consonants are used: b, d, g, k, l, m, n, p, r, t, w, y, also ch, sometimes better rendered by j, and ng, which has the soft nasal sound in all but one or two exceptional words. The combination ph occurs in the native name Pharaphara, for Chasm Island; on p. 64 and on the map this is spelt Phara-pbara in error.

F and s cannot be pronounced; thus 'Fiji' is 'Pichi,' and my name 'Mita Jindere.'

The tribal name, Ingura, is used also for the language in the form 'Ingurawala,' which may be literally translated "Ingura fashion."

The Ingura language is not entirely pure. The men of the Bartalumbu section are in frequent communication with the Nungubuyu tribe, and have adopted and modified some of the mainland words, and thus may have alternative words for the same object.

In the Ingura language words with initial l and r are rare, but occur more frequently in the Nungubuyu language.

ENGLISH.	INGURA.
accompany	yagukwa
adam's-apple	yambiya
afraid	niyalenau
aim, to miss	yingua, nnagualpa
all, or full	buruku
anchor-stone	amora
angry	nabada
animal food	akwalia
ankle	ununder
ant, little black *(Iridomyrmex)*	nouma
ant *(Iridomyrmex detectus sanguineus)*	mardawa
ant, green tree *(Oecophila smaragdina)*	urumuraia
anxious	nejagauran
arm	ayaramur
armlet, feathered	nnjija
armlet, cane	yurudo
armlet, string and fur	mieji
ashes	amanina
ask	yininaguma
baby	wijigia, wijigaigia
back	reripe
backbone	mereabu, iyungder
bad, ill, starved, thin	aoraria
bail out	wadamaigina
bark (tree)	alugara
bark (dog)	nawadina
bat	momambaruku
bathe	nambaina
beads	minimini
bee, native	najangkachea
bee-eater *(Merops ornatus)*	innabutau
beetle *(Chrysomelid)*	imangwu
beg	liugumeigia
belly	mulukwa
belt, hair-	abalumukwu
belt, woven string-	ilerupi
big	aruma
billabong	awurukwu
bird	yurumba
bite	nanguya, ongina, oniya
black pigment (wad)	udumach
blackfellow	yaramamaji
blanket	juluna
blind	nimimbu, nimibadena
blood	yayari
bloodwood tree	andua
blow	ubukwa
blow the fire	ubukwangura

ENGLISH.	INGURA.
blunt	abayua
bone in nose (also septum pierced)	anyungunyi
boomerang	aribina
bottle-brush tree (*Banksia dentata*)	anindurukо
boy	wiyideaba
boy, big	umuinajirere
break	ningaena
breast	yugunduguda
breathe	ninganguya-nina
brother	nawa
brother, little	nanigama
burrawang (*Cycas media*)	manunga
burrawang fruit	ananga
butterfly	mabangari
by and by	ambagambaga, ambage
canoe	levaleva
carry	nabuguda, ningabuguda
catch	wagaena, yuga
catfish	imuturungu
ceremonial poles (large)	imudunga
ceremonial sticks (small flat ones)	yumuntungu
ceremony, Amalipa	abumayang-pena
ceremony (circumcisional)	unamalia main-diwila
ceremony (for dead)	yingijungunda-gena
ceremony (over a bone)	alalukiyina
chalcid wasp (in figs)	oragigi
cheek	umugura
chest	gotogoto
child	uraruma
chin	angundu
chiton	emumokaro
cicatrix	inungundu
circumcise	mabalila
clapping-sticks	alyinkpa
clever	uguruma
close up	agudan, agudangwu
cloth	tunkumulya
cloud	aubina, unubina
club	mabarakwu
cockatoo, white (*Kakatoe galerita*)	towateru
coconut	kalukwa
cold	numudata, numuradi
cold wind	mumareka
come here	yangoranukwa, kwa
come up (lit., arrive)	mijuner, mubugei
come back	lilogunga laurada
come quick	yarakaja koyo
coral	mulareru, ritani
corrobboree (play-about)	maiyungena
cough	umudilya
cover	urugamba
crab	oreni
crane, white (*Demiegretta sacra*)	wililembilbia
creek = small river	achraradaluma
crocodile	dougarapia
crooked (track)	ayungiana
crow (*Corvus*)	ningua, euyungu
cry	nuadina, unader
cut	abalia, urugandina, urinadina
cut out a canoe	wereatea levaleva, oratea levaleva
cypress pine (*Callitris*)	imintungu
dance (to)	alukwanja
darkness	nibadena, aruma
daughter	nadija
deaf	nabumada
deep	mungaraba
desire	akambila
die	achunga

ENGLISH.	INGURA.
dig	mungadinya
dilly-dag	yeiril
dirt	ajarunga
dish	mangu
dog	uruwadu
down sail	winaraga tumbala
draw (to) or paint	yinganaru
drink (water)	(agungu) begina
drone-pipe	yeraka
drop (to)	nangilaru
duck *(Dendrocygna eytoni)*	uraminyi jangajanga
dugong *(Halicore australis)*	inungulangu
eagle, whistling *(Haliastur sphenurus)*	tomaruru
ear	matt
early	udaia
eat	ningiyambina
egg	einumamo
eye	mempe
fall down	nalara ningnalara
fat	amungyi
fat man	lililyipieta
father	nanna
fetch	uranguna
few	wiabaura
fig tree *(Ficus glomerata)*	nungarata
fig	manyungunyi
fig wasp	oragigi
fight	nuumada, nuadarina
fill it up	naiyamburuku
find	ninababurenga
finger	amamo
finish	inguru nugada
fire	angura
firelight (also burning dry pandanus torch)	nuabiyarunda
firestick	mianga
fish (used also for any animal food)	akwaia or akwalia
fish-hook	bigangi
flat	ariba
fly	yanguru
flying-fox *(Pteropus)*	umumulgu
food	anunga, unina
foot	aluka
forehead	arra
forget	yankwuwuna
friend	yakwamura
frog	dadunagunaba
frogmouth *(Podargus strigoides)*	yokoroko
full	nulada
gammon	ninigada, negada, niawali
get it	uranguna
girl, little	didaraba, umumajiaera
girl, big	dilabagiaera
give	nga
go ahead	nanalaga
goana	yaraja
go away	jeilikaja
good	aningappa
good boy	malukwa
good-bye, or finish	nauo, wia
goose *(Anseranus semipalmatus)*	yi-ngagia
goshawk *(Astur fasciatus)*	urarabura
grandfather	umura
grass	umada
gray hair	yingura
greedy	umambira
grow	ariragiira
guardian of initiate	nababo
guningyara fig tree *(Ficus glomerata)*	nungarata
hair	mamunkwa
hand, also arm	ayaruka
handle	umadaba
hang up	waialiadingia
happy	aruma, nanubadena
hat (ceremonial head-gear)	jangu
head	arunga
heart	anungua
heavy	angabu wanwana
here	amanga

ENGLISH.	INGURA.
hit	neiyungkwarea *or* wiyabari
hold	umia
hole	ameidira
honey	ilyaku, iyakwu
hungry	amariadi, amuraia
hunt for food	aunugaoa
hurt	umbagulangu
ibis *(Threskiornis molucca)*	ulamba
Ingura language	ingura-wala
initiate	nanigi
intestine	ningalada
iron	umwara
ironwood *(Erythrophlaeum)*	memberuko
island	iungadarabu
jabiru *(Xenorhynchus asiaticus)*	dunmukulia
jequirity seeds *(Abrus precatorius)*	iyumerire
jump	kwabijanga
keep	wilyagina
kick	nungaja, nungalilaja
kingfisher, forest *(Halcyon macleayi)*	tomonkoro
kingfisher, blue *(Alcyone azurea)*	oranjenjenura
kiss, lick	nilaranga
knee	eini
knife	ulajaria
knife, metal	lalingi
know	nagaguruma, naragaguama
know, do not	neigurugunga
lame	nirumada
laugh	umunga
laugh, to make	mangina amanga
lawyer cane	iyurude
leaf	umada, uijia
leech	yaruga
leg-bone	mangari
let down (anchor)	mungulupa (amora)
lie	niawali
lift	umiya, umiyagina
lift up	walmuchia
light	nigiyaraba, umbila
lightning	nungunimunda
like	nanaguu
lips	amamindu
listen	agirigia, wanguraja yakwa
little	agira
lizard	dungulua, iwujera, yigarama
long time	arokpa wia
long way	awilyigara
lorikeet *(Trichoglossus rubritorquis)*	magijia
lubra	udaringa
lung	undinda
make	unipraka, mangaporaka
mangrove	umuma
many	yababuna
marchfly	yorangu, yowamu
married man	naninga
mast	balyara
me	naiuwa, ngaiua
milk	ungamini
mine	nganyangu, niyuunga
miss aim	yingua nuagualpa
moon	imora
more	moraia
mosquito	tanana
mother	dunda
moustache	gimina
mouth	dunda, alalyupa
mud	aminenji
music	nalubina
nail, iron	baju, umwara
native companion *(Antigone rubricunda)*	nguruku
native plum tree *(Buchanania muelleri)*	araroworo
navel	mindilaukwura

ENGLISH.	INGURA.
near	agudan
near me	naiyuamaji
neck	yambia
necklace	minimini
needle	jaru, yaru
new	wararuguma
no	nari
no good	aoraria
no more	urabaura
nose	amindu
nose-perforation	anyuenya
nose-stick	agkamera
not many	wiabaura
not true (*see* gammon)	
nothing	naragumunga
nutmeg (*Myristica insipida*)	nadianjaroko
old man	waniaringa
oriole (*Oriolus flavocinctus*)	dejoru
other side	abaungar, narumakunun
pad or track	manadi
paddle to	madayina
paddle	miaja
paint up	adamuga
pandanus	mangurukwa magurungu
paperbark	alyukuru
paperbark tree (*Melaleuca*)	ranungi
parrot (*Aprosmictus erythropterus*)	maerumija
pearl	oumbakalang
pearl-shell	mutiara
pelican (*Pelecanus conspicillatus*)	tumapula
phasma (stick-insect)	urumiapia
pick up	aginma umiya, youkwa
pierced septum of nose	anyuenya
pigeon	dawarakuku
pinch	amagilya
pipe	ilyara, mada
pipe, bowl of	amamindu amugura
play	yumeiyungena
playabout	mayungena
plenty	yababuna
porcupine	dinginuga
pubic tassel	mapini
pull	urimaga
pull up (anchor)	magiguma (amora)
pull (rope)	urimaga baiyupeyu
pull down (sail)	urinaraga (tumbula)
pull up (sail)	urinalaraia (tumbula)
push	ugiriena
put down	wakuma
quick	uradukwa, winancha
quiet	naruninja, aminya
race	magikuma, umaeingena
rain	yaiyukwa
rainbow	yingani
rat	nimeana kuma, orandinda
red ochre	maruwura
rib	meirigura
rice, wild (*Oryza sativa*)	birija
right	adinibanya
ring, nose-	amindaoa
ring, spear	manjurataoa
rise up	nangilangbaga
river	adaluma
rock	awanda
rock oyster	arugura
roll up (sail)	urinungundi yuka
root	amugayara
rope (cord)	widiri
rope (big dugong)	meira, mangaruku
run	maia ungara yaia
sail	tumbala
salt water	magada
sand	aturinga, arupingi
sandalwood	domborombo

ENGLISH.	INGURA.
scrape	nunilijana
scrub-fowl egg (*Megapodius reinwardt*)	inikappuru
see	undia
send	olaria
sew	narawaragina
shadow	ayalmura, umarijaga
shake	wiyirerika
shallow	abilalya
sharp (knife)	urungunga
sharp (point)	linundina
sharp (stake)	anungtangu
shelduck (*Tadorna rajah*)	orakarupu
sheoak (*Casuarina equisetifolia*)	moragi
sick	ajunga
simple, foolish	nabumanagini
sinew	ayara
sing (evil enchantment)	nebingarayan
sing	nalubina amaippi
sister	nangu
sit down	ambaria
skin	amagulia
sleep	mungulia
sleep (soundly asleep)	manaungula
slow	walanjukwa, abagulanga
slowly	walanjukwa
smell	ning bagina
smoke	umara
snake	yingana
sneeze	anyuru
soft	amagulia
sole	umulya
son	nanigama
sore	ajigama
sorry	naniwana
spear, dugong	anulganulba
spear, fish	makuru
spear, wood barbed	manjurata
spear, wire	dudabada yata
spear, stone or iron bladed	lama yata
spear, stone or iron head of	lama
spear, shaft of	awawara
spear, shaft of dugong	ingungulangu yata
spear-ring (rattan)	manjurataoa
spit	alukwalye, ayungula
spoonbill (*Platalea flavipes*)	umalara
stand up	walmachunga
star	warawara
stone	awanda, malara
stop	narijeiduga
storm	meiuwa
straight	ariba ayungadabura
strike dead, kill	wiyabari achunga
stringybark tree	alugura
strong	agaraga, nabadiyaia
suck	numabijinya
sun	mamura, aijuma
sunset	alamuda
sweat	nawaribura
swim	yiamena
sword grass	iyumunda-ngara-ngara
tail	mamudabu
take	uilagina
take away	waiyaragina, amarukachia
talk	yanguina, niambaina
tall man	amangirira
tapping-stick	alyinkpa
teach	nayambina
teeth	akarunga
tell	yumagina
termite	urumarunga
termite-nest	abinga
thigh	makare
thin, poor	aoraria
this side	alagarada
throw	aripa
throwing-stick, flat	yumangala
throwing-stick, round	yikalpu, yukarupu

ENGLISH.	INGURA.
throwing-stick, spade handle	lupuyepilya,
thunder	mamuntunga iminwara
tide, low-	magaina
tide, high-	magaina-laurada
tired	marina, una-winangajang
tobacco	jambaku
to-day	atoapa
toe	amamoaluka
toe-nail	inane
together	aminuga
tomahawk	bangalijina
to-morrow	anukwaye
tongue	alalyupa
torn	nagura
tortoise, freshwater (*Chelodina*)	dingaloa, dingalara
track, or spoor	munaruku
trepang	taripan
true	agiyaraba
turd	langu
turn around	uruwaru-kachea
turn firestick	umabagina
turn over	nuwarukachia numugaina
turn right over	naruguli
turreted white-ant hill	apinga
turtle, shell-	imoraga
twist	marugilyu-gajinya
vein	yayari
wait	naguragina
wake up	marachunga
walk	umbagulangu
wallaby, river (*Macropus agilis*)	iprata
wallaby, rock	dilandu
want	akambila, yukakwa
wash	mangudina, nambaina
wasp	imegumegina
water	agungu
waterfall	wagana
wattle	meruku
waves	meiruwa
weak	naruraba
what is it?	miapena magini
whiskers	ayama
whistle	urimigia
white ant	urumarungu
white gum tree	inarupu
white man	orobanda, urubalanda
white paint (pipe clay)	tongura
wild dog	wanugwane-baleba
wind	aruru
wire	umwara
woman	udaringa
womb	daduuga
wood	eiga
yellow ochre	otarak
young man	wanumamalia
you	nungua
yours	nungulangu

Notes on Vocabulary.

The word 'wia' is used chiefly by the Bartalumbu men, and 'nano' by the rest of the Ingura. It is a word of farewell, with somewhat of the meanings of each of the following words: stop, finish, go away, good-bye. At spear-throwing ordeals (either ceremonial or serious affairs), when the leader of the prosecuting party says 'nano' all hostilities are ended.

'Amagulia,' the word for "human skin," is used for "soft" also, anything soft being compared with the skin, the best object for comparison they know of.

The following words and phrases are literally translated:

wia	good-bye
jailikaja	go away
winancha	quick
yangoranu kwa	come here (to two or more persons)
winancha kwa	quickly (all) come
winanchilikaja kwa	quick, we are going away, come
wonanchapowia	quick, we are going
yarakaja koyo	come quick
naiwa	me
amanga	here
ambaria	sit down
naiyu amaji ambaria	sit down by me
narambila yolokwa ambaria ..	I like sitting here
umunga	laugh
mangina amanga	make all here laugh
akambila jambaku	I would like tobacco
yukakwa jambaku ambilima ..	we would like two tobacco (sticks)
wanguraja yakwa	you listen to him

There is no single word for "kill" in Ingura or any of the other languages mentioned; 'wiyabari achunga' consists of two words meaning "to strike" and "to die." Thus in some mainland tribes that speak English one hears: "I bin kill him, him bin die"; here "kill" means "hit."

	NUNGUBUYU.		INGURA.
1	ajabungich		auliaba
2	ulawa		ambilima
3	ulangbaj		abliakalpia
4	umarununbaj or ula(wa)ulawa		abuiabua
5	maraungui		amukuale
6	maribalibulla		amukuale auliaba or anke
7	maribamalibala		amukuale ambilima
8	maragara		amukuale abliakalpia
9	mugarawindi		amukuale abuiabua
10	uwalagula		amambaruku
		11	amambaruku auliaba or anke
		—	etc.
		15	amabwukuale
		16	amabwukuale auliaba or anke
		—	etc.
		20	ogripulung

The islanders use a modified quinary system of numerals, up to twenty. Six is thus "five-one," or sometimes a special word, seven is "five-two," and so on; ten, fifteen, and twenty, each have special names. Beyond this figure they do not usually count, but on one occasion an old man of Talakurupa counted up to forty, laying short sticks down, grouped in fives. He started the second score

with twenty; one, mentioned two fifteens and again two twenties. He then referred to other sticks which he placed down as 'yababuna,' meaning "many." On another occasion, when we demanded one hundred and fifty spears from the men of the same local group, as a punishment for the pilfering of metal objects, we indicated the extent of our demands with the aid of our ten fingers and fifteen sticks; they afterwards brought up and surrendered the correct number, mostly tied up in bundles of twenty.

In announcing numbers they are indicated concurrently on the fingers. Small quantities or small portions of a whole are indicated in a similar manner by holding the little finger of one hand with the thumb and forefinger of the other, the value of the fraction being indicated by the length of the little finger exposed.

The Nungubuyu on the mainland use a somewhat different system. They have special names for each numeral up to ten, and usually count in two's; four is often called two-two, and in counting with sticks they lay them down in pairs.

The Mara, Ngandi, Rembarunga, and other mainland tribes have words only for one and two, greater numbers being indicated by the word "many." The Mara numerals are 'wagin' (one), 'nruja' (two), and 'jari' (many). The Nungubuyu word for fingers, and also hand, is 'maran,' and the root appears also in the words between four and nine. The word for ten is a combination of the word for two and 'gura,' another word for hand.

The Ingura word for finger is 'amamo,' and the root of this appears to be represented in the word for ten.

Sign Language.

Besides the silent communication signs described on p. 81 in connection with spear-fishing there are many others, a few of which are here noted:

(*a*) Beckoning with all the fingers at once, hand palm down, indicates "come here." (*b*) Expanding the body, and rubbing it with the hand, while sticking out the tongue, is a sign of mockery or defiance. (*c*) Swelling out the cheeks and tapping one with the forefinger is a sign for water. (*d*) Drawing in the abdomen and rubbing it with the hand is a natural sign for hunger. (*e*) As already mentioned, a downward cast of the hand, with the thumb at right angles, means "no." (*f*) Two fingers placed on the upper lip, just below the nostrils, is a sign for tobacco. (*g*) Small quantities, as before mentioned, are indicated by holding the little finger with the thumb and first finger of the other hand.

In the Mara tribe the signs *a*, *b*, *c*, *d*, *f*, and *g* are also in use; that for tobacco is slightly different, the two fingers being vigorously sucked.

In the Ngandi tribe the sign of defiance is a very effective incitement when two quarrelling parties are summoning courage for a fight.

Macassar and Malay Influences in the Past.

Several of the old men of the Ingura tribe, as youths, made voyages with the Malays, principally of Macassar, who regularly visited the North Australian coast until about twenty-five years ago, and are familiar with the language of Macassar, with sometimes a smattering of other languages, such as Bugi and Malay. In the past other natives went away with the Malays, and did not return. Formerly these foreign people were always visiting them, but since Nokwari was a young man, and had made the round trip to Macassar, and learnt the language, they have ceased to do so. Nokwari, shown in fig. 31, is now a man probably over fifty years of age.

One very old Bartalumbu man, Yambukwa by name, was taken away before initiation, and spent many years in various foreign places, returning as a middle-aged man. He was then initiated, but the elevated body-scars would not form, turning instead to large sores, which left big flat scars. He told us of woolly-haired Papuans, of Timor Laut, Macassar, Ké, Aru, Banda, and many other places which I could not recognize by his names or descriptions. With the aid of one of our crew, a Macassar-Torres Strait half-caste, who conversed fluently with him, something was learned about the visits of the Malays.

They were always gathering trepang (taripan), turtle-shell (imoraga), sandalwood (domborombo), pearls (oumbakalang), and pearl-shell (mutiara). The trepang was plentiful in places about the island, and the natives were employed in gathering it, receiving cloth, rice, tobacco, and gin in return. The turtle-shell, pearls, and pearl-shell were also gathered by the natives. Pearl-shell was plentiful on the coral reefs about the island. On asking the old men to find some pearls for us, they brought a few seed pearls and one large, pinkish-white clam-shell pearl an inch or more in diameter. The latter had been ruined, however, by the cooking of the creature from which it had been obtained. Since this would have been worth several hundred pounds, according to a pearl buyer at Thursday Island, it indicates the inducement there was for the Malays to visit the coast.

In several sheltered bays and creeks on the northern and western sides of the island (North-west Bay, Spencer Bay, Bartalumbu, Angoroko, and Yetiba), and at Woodah, Winchilsea, and Bickerton Islands, there are many traces of Malay occupation, including large groves of giant tamarind trees, forming prominent landmarks. At Spencer Bay these trees extend along the eastern shore for over a mile, and there is another grove on Winchilsea Island. These

localities, with the large, sheltered, muddy-bottomed bay, and the narrow, river-like channel leading to North-west Bay, formed the principal encampment of the Macassar men. It was known to them as Dailumpu. The old anchorages are marked with stakes. Ashore there are large kitchen middens of shells (*Arca trapezia*) and pearl-shell clippings, the remains of drying ovens, fireplaces, and several graves. At Winchilsea Island there is a cemetery under some tamarinds. Each grave is indicated by a low platform of coral and shells about six feet long and three wide, with remains of a stake or carved grave-post at one end. One of the best preserved graves, evidently that of a person of importance, is shown in fig. 53, with two others, marked by stakes in the background. The native soaks near these camps have in some cases been enlarged and lined with stones to form wells.

The old man said that the Macassar ships came when the wind was blowing from the north-west, and stopped at Dailumpu. Only a few ventured further south than the island. Flinders, however, records traces of Malays as far south as Sir Edward Pellew Islands. There are traces of them also at Maria Island.

The difficulties of navigation and adverse winds probably prevented many of the traders going further south. Groote Eylandt was the gathering ground of the fleet. In its vicinity there are many camps, some of the Malay names for which the old man knew. These were: Cape Barrow, 'Ochong'; Blue-mud Bay, 'Jirapi'; Caledon Bay, 'Mangula'; and Roper River, 'Wekia.'

In addition to the articles previously mentioned the Malays gave tomahawks, knives, and nails. The tomahawks were specially treasured by the natives, and one or two, very much worn, were noticed in their possession. Stone knives and spearheads had not been supplanted. Metal nails for fish-hooks were common articles of trade, and the oldest men said they had never used anything else.

The influence of the Malay on the ceremonial life of the native is almost negligible.

The Malays whenever possible obtained possession of native women and took them away on their homeward journeys. The Ingura native thus learned that the women should never be seen. The island natives, being comparatively few, were frightened of the Malays, who robbed them, enticed them with drink, and beat them when they would not work. Their attitude toward the Malays was one of hate: sometimes they tried to kill them, and stories of ambushes and attacks are told in the camps.

A sufficient period has elapsed since the introduction of the sailing dugout canoe for the sea-faring habits to be well engrafted on the islanders and on the Nungubuyu people. That the methods employed are acquired seems certain. The methods of opening out the canoe by means of fire and hot water are identical with those practised by the Malays for centuries, and the manner of rigging and

sailing are identical with those in former use among the people of the southern Moluccas and Java as far back as the end of the sixteenth century. Rouffaer ([15]) gives a figure of an outrigger canoe in which the sail is identical. He also figures a Macassar 'djoeng' of the type which visited the shores of the Gulf of Carpentaria. I have a tracing of a drawing by an old Ingura man which resembles it closely in outline.

The Ingura called the Malays either 'Makasa' or 'Malayu.' The white man they call 'orabaranda,' 'urubalanda,' or 'orobanda,' which is very similar to the Malay term 'orang balang,' meaning "hairy man," or "man of adult years." The Nungubuyu people call the Malays 'Chudaka,' and the white man 'Monanga'; this last term being the one common to all the inland tribes met with.

The following is a list of words in common use on the island to-day which are probably all of foreign origin. They have not been compared with Macassar or Bugi vocabularies, in which the sources of some will probably be found:

INGURA.	ENGLISH.	COMMENTS.
bagalijina	tomahawk	
baju	nail	
birija	rice	biras (Malay), birinj (Hindustani).
budula	bottle	
buyali	pannikin	buli, a little pot (Malay).
dangduna	pot	
diura	book, letter	Malay, according to the Rev. J. C. Jennison, who says the Goulburn Island word is the same.
jambaku	tobacco	tambaku (Malay).
jinapa	gun or fire-lock	senapang (Malay), snaphaan (Dutch).
kalewang	knife	
kaluka	coconut	kalonko (Malay).
kapara	cloth	
kopela	steamship	kapal-api (Malay) (api, fire)
kulubadu	house	
lalingi	knife	lading (Javanese).
mada	pipe	pamadutan (Malay).
Malayu	Malay	orang Malayu (Malay).
michanga	sailing vessel	
mishung kopela	motor vessel	
mutiara	pearl-shell	indong mutiara (Malay).
oumbakalang	pearl	mutiara (Malay).
ruti	bread	roti (Hindustani).
tumbala	sail	balayer, to sail (Malay).
tunkumulya	cloth	
umwara	iron	
yalanda	blanket	
yalwara	trousers	

([15]) Rouffaer, G. P., *and* Ijzerman, De Eerste Schipvaart . . . naar Oost-Indie . . . 1595-1597. Gravenhage, 1915, pl. 27-28, etc.

In fig. 64 a and b both sides of a painting on a flat slab of ironwood are shown. Fig. 64 c and d show both faces of a carved message-stick, made from a piece of cypress pine. Two types of clapping- or tapping-sticks are shown in fig. 64 e and f; they are used as the accompaniment to drone-pipe music and

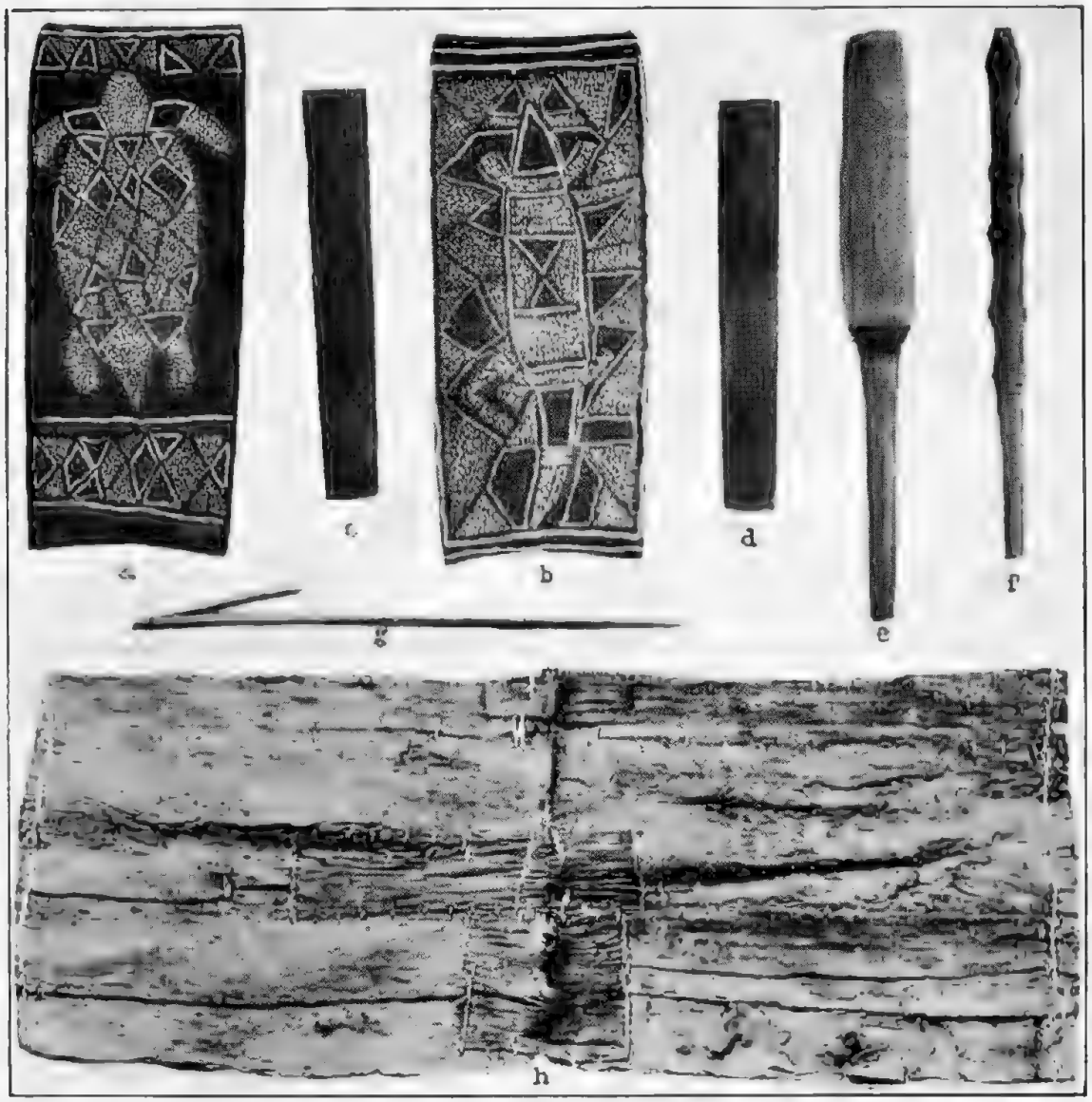


Fig. 64. a, Painting on ironwood (turtle); b, the reserve (lizard); c, carved message-stick; d, the reverse; e, paddle-shaped tapping stick; f, ordinary tapping stick; g, spindle for hair-string making; h, woman's sewn bark sheet.

dancing, either in pairs, or one is tapped against a throwing-stick, hollow log, or other suitable object. Many different shapes are commonly made; one of those illustrated is in the form of a paddle.

Mr. Lousada informs me that secrecy is still maintained regarding women, and that they have been seen only on three occasions during the past three years. The bark wrapper shown in fig. 64 h is one of two obtained from them. It is eighteen inches wide and four feet long, and is composed of five long strips of paperbark sewn together with cane. It is much worn and patched with numerous pieces of the same material. When walking, a woman holds a wrapper in front of the body with one hand. When seated she folds it transversely along the middle line, and stands it alongside her as a modesty shield. When not in use it can be folded again along the middle longitudinally. The description given on p. 101 is misleading, as the total width is eighteen inches and the fold or folds are transverse. The Nungubuyu bark apron referred to is similar to that figured, but is much smaller.

Additional Notes.

In dealing with methods of gripping spear and throwing-stick (p. 99), no mention was made regarding the position of the fingers. The spear, as shown in

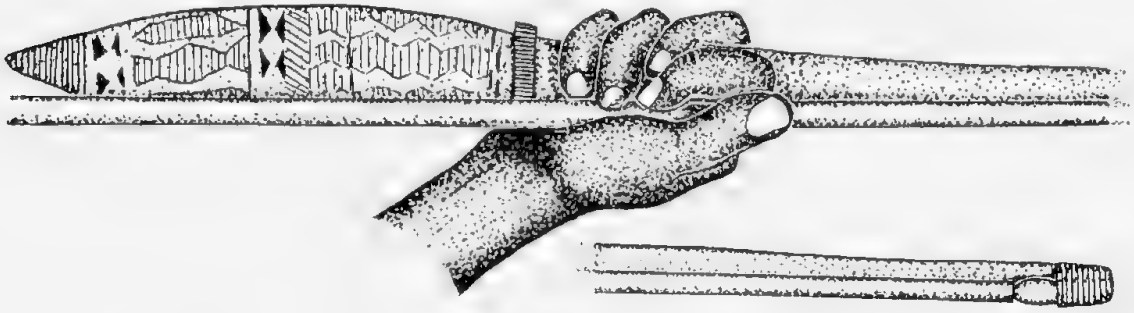
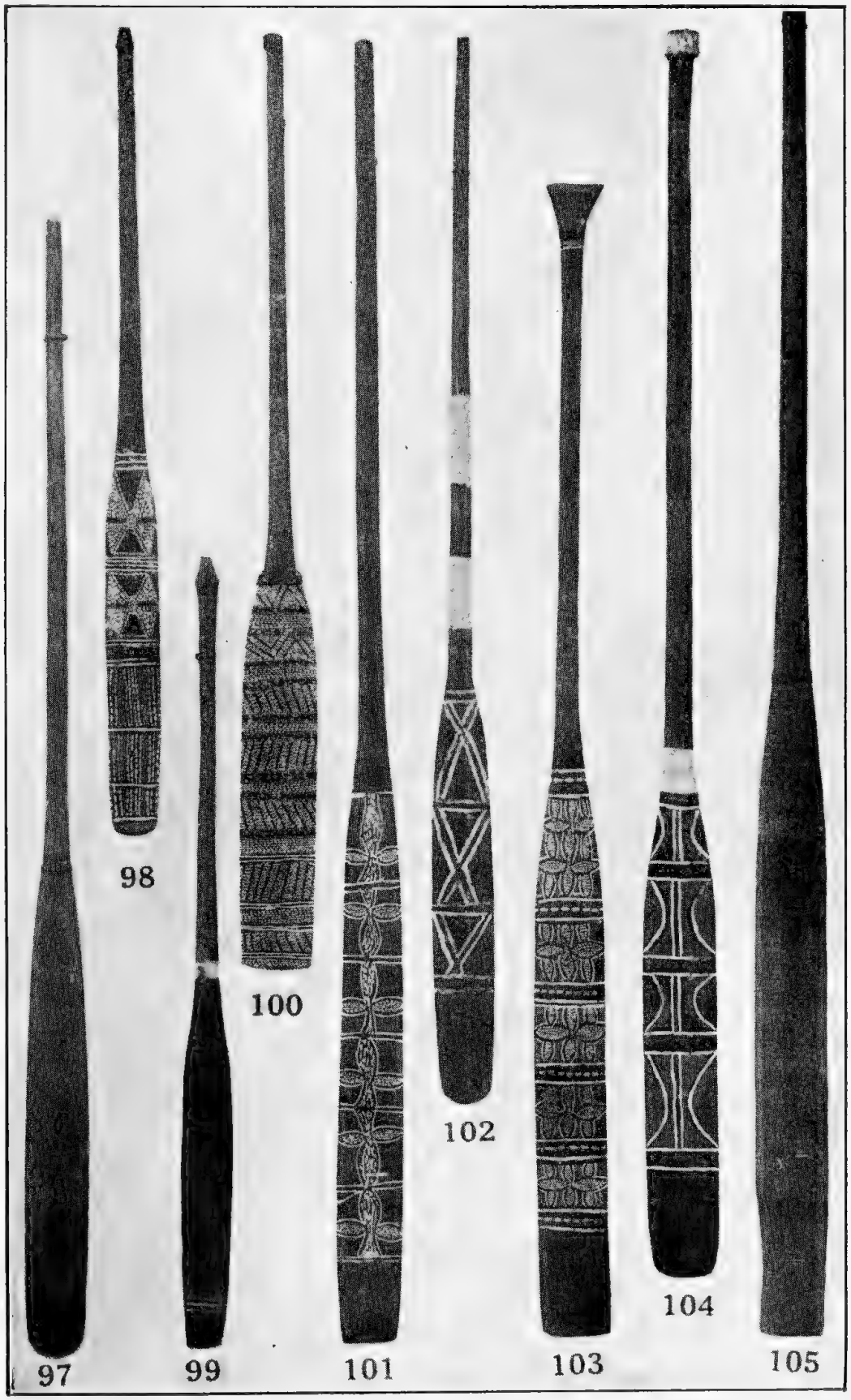


Fig. 65. Ingura method of holding 'mamuntungu' and spear.

fig. 65, is held between the first finger and thumb, and the throwing-stick between the first and second fingers. The flat handle is held edgewise, as shown, and in throwing offers little resistance to the air.



PADDLES, GROOTE EYLANDT.

A YOUNG BLUE WHALE

BY EDGAR R. WAITE, F.L.S., C.M.Z.S., DIRECTOR, SOUTH AUSTRALIAN MUSEUM

Summary

In an article published earlier in this series I described and figured some features of a blue whale over 87 feet in length, taken at Corvisart Bay, South Australia.
I am now able to offer a few notes on a young example of the same species, and the accompanying illustrations have been prepared, for the most part, for comparison with those of the adult specimen referred to.

A YOUNG BLUE WHALE

By EDGAR R. WAITE, F.L.S., C.M.Z.S., Director South Australian Museum.

Text figs. 66-76.

In an article published earlier in this series (1) I described and figured some features of a blue whale over 87 feet in length, taken at Corvisart Bay, South Australia.

I am now able to offer a few notes on a young example of the same species, and the accompanying illustrations have been prepared, for the most part, for comparison with those of the adult specimen referred to.

The young whale was stranded on the extensive flats at the head of Gulf St. Vincent, but the occurrence was not generally known until some little time later. During conversation with a Greek fisherman at Port Wakefield I learned

Fig. 66. The young blue whale on the beach.

that he had noticed the animal floundering some 400 or 500 yards short of high-tide mark, but not seeing any personal gain he had kept his observation to himself. After death the carcase drifted shoreward, and was then visited by sightseers from Port Wakefield, ten miles distant, and elsewhere. I was also early on the scene, took the photograph (fig. 66), and made the following external measurements.

(1) Waite, Rec. S.A. Mus., i, 1919, p. 157, pl. xxi-xxvi.

	Metres.	ft.	in.
Length from tip of snout to caudal notch ..	7·417	24	4
" " " eye	1·295	4	3
" " " dorsal fin ..	5·258	17	3
" " " pectoral fin ..	2·083	6	10
" " " penis	4·419	14	6
" " " vent	4·978	16	4
Width across flukes	0·838	2	9

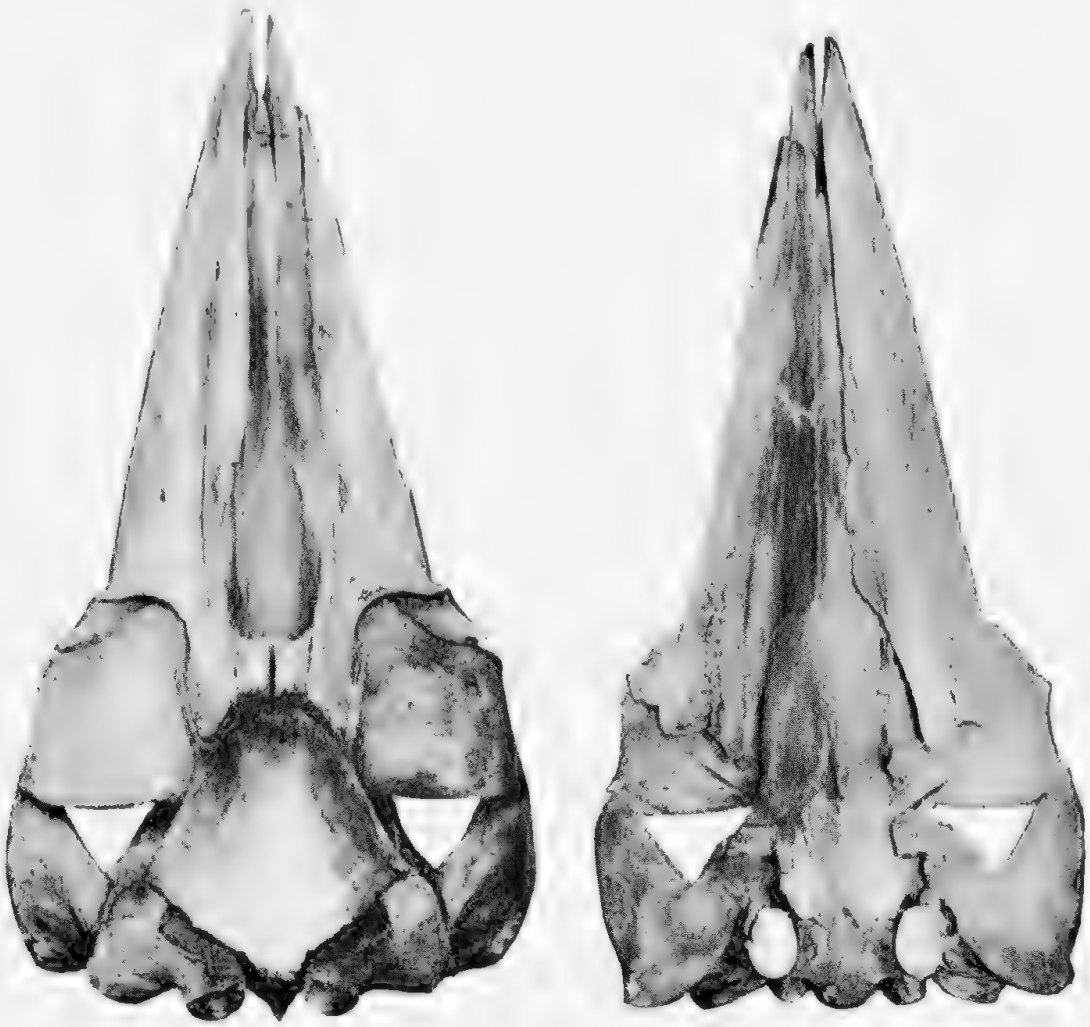


Fig. 67. Skull, upper and lower aspects.

Six weeks unfortunately elapsed before I was able, in company with Mr. O. Rau, one of our articulators, to take over the specimen and have its skeleton prepared for transportation. By that time decomposition was somewhat advanced, and the condition precluded the possibility of making several desirable observations. The body bore no marks suggesting injury; it is probable that the young whale was still a suckling, and that its mother had been killed.

On opening the carcase it was found that the animal was very young, the cranial sutures were quite open, the vertebral processes distinct from the centra, as were, naturally, the various epiphyses from their proper bones.

Fig. 68. Frontal and left maxilla, showing complex suture.

To account for the absence of reference to some of the smaller bones, such as the hyoid and sternal elements, it may be mentioned that, for special safety, they were placed in a petrol tin. Other bones were bagged, the whole being packed in a dingy, towed by a motor boat. During the ten miles trip on September 16, 1925, a hard blow was encountered, and the dingy was almost swamped; the petrol tin, with its contents, was washed overboard, but the other bones and the baleen were saved. A more detailed account was published in the daily press ([2]).

([2]) Waite in Adelaide "Register," Sep. 19, 1925.

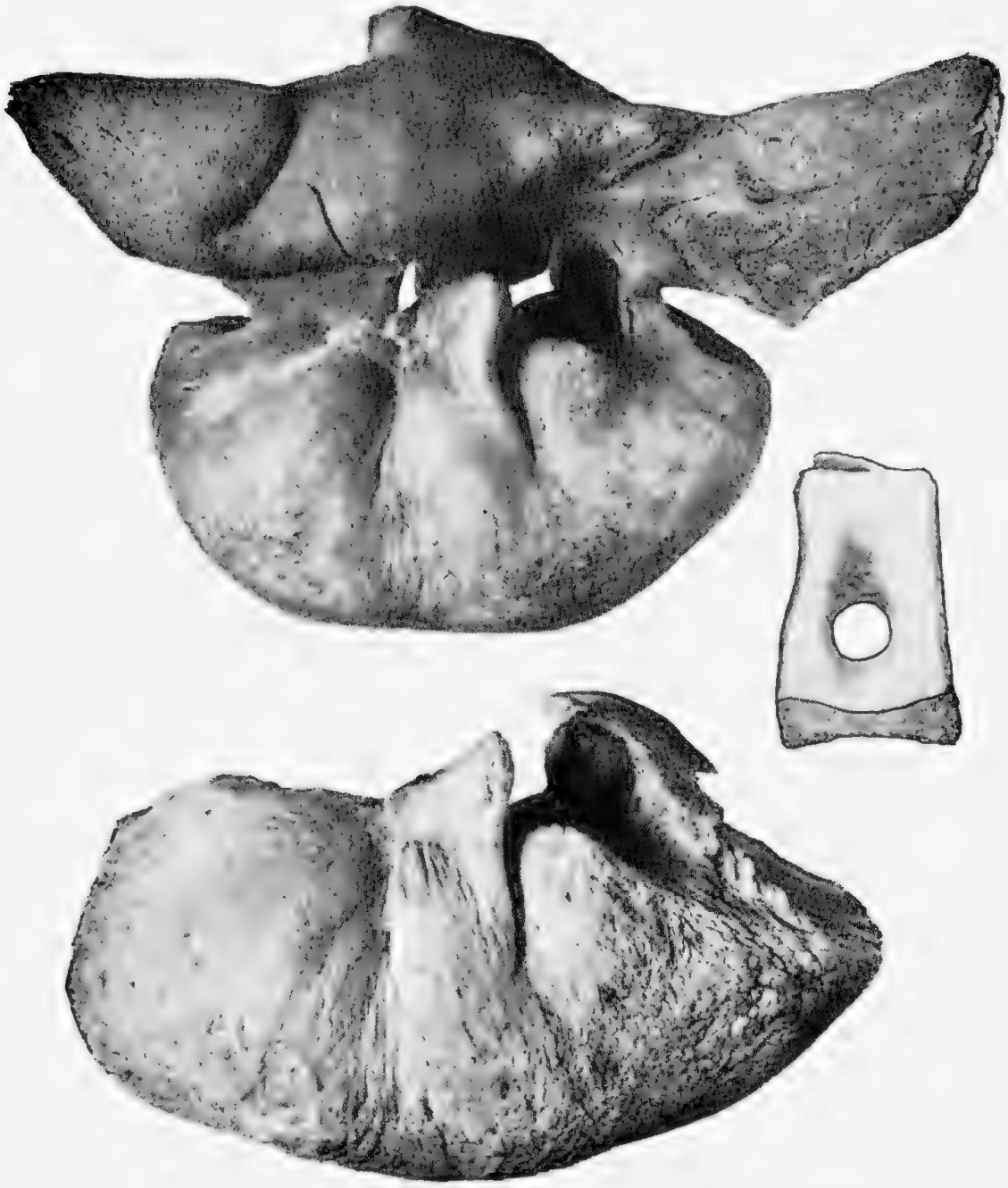


Fig. 69. Bullae, upper figure, young, lower figure adult, reduced to same scale; inset, stapes of young enlarged.

Skull. Photographs of two aspects of the skull are shown in fig. 67. In common with the rest of the skeleton, the bones of the cranium are spongy, and show little indication of ossification; this is likewise true of the mandible, which, in the adult, is formed of particularly dense bone ([3]). As the components

([3]) Waite, Rec. Cant. Mus., i, 1912, p. 325.

of the skull came apart, the nature of the sutures was readily ascertained; that between the frontal and maxilla is the most complex, consisting of a series of vertical plates fitting correspondingly deep grooves, and shown in fig. 68.

It is well known that the human auditory ossicles do not increase in size, that they are as large in the new-born babe as in the adult. Holden (4) wrote: "All the bones in the tympanum are ossified at birth. More than this, they are

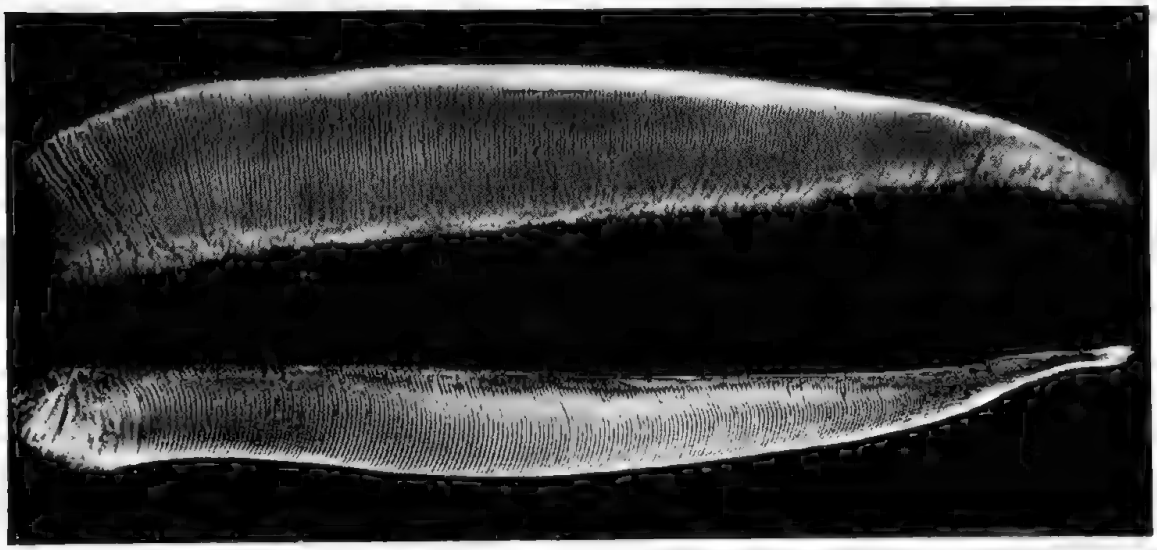


Fig. 70. Baleen, upper figure outer aspect, lower figure basal aspect.

well developed at birth. I have before me the tympanic bones of an infant at birth and those of a man who was seven feet high, and there is not much difference between them in point of size." Dr. Burnett (5) writes: "The auditory apparatus of a child differs in some respects from that of an adult. In the child the auricle and the auditory canal are much smaller than in the adult, while the membrana tympani and the ossicles in the middle ear are of full size at birth." This may be so in other mammals; it is substantially true in the Cetacea, and figure 69, illustrating the bullae in young and adult, shows that the main noticeable growth of the tympanic bone concerns certain external features, such as the production of angles and rugosities, the body of the bone and its contained ossicles remaining practically unaltered. In his paper on the Morphology of the Mammalian Ossicula auditus, Alban Doran (6) describes and figures the ossicles of several whales, including those of *Balaenoptera rostrata* (pl. lxii, figs. 30, 31), to which those of our present subject are very similar. The stapes, which fell out during maceration, is shown at the inset in fig. 69.

(4) Holden, Human Osteology (ed. ii), 1857, p. 245.

(5) Burnett in Keating's Cyclop. Diseases of Children, iv, 1890, p. 2.

(6) Doran, Trans. Linn. Soc. (2nd Ser.), i, 1899, p. 371, pl. lviii-lxiv.

The following are some dimensions of the skull:

	Metres.
Length	1·628
Width	0·812
Interorbital width	0·220
Length of mandible (symphysis abraded)	? 1·293
Girth of mandible at coronoid	0·520
Girth of mandible in advance of coronoid	0·355

Baleen. To photograph the twenty feet or so of baleen provided by an adult blue whale is probably seldom feasible; to obtain a picture of that of the juvenile under review presented no great difficulty. Two views of the baleen of the right side are here supplied, but the proximal end of the series is not quite complete. Fig. 70 shows the outer and basal aspects respectively; the complete series measures 1135 mm.; the longest plates, which occur near the proximal end, are 175 mm., and each entire series comprises about 374 plates.

Fig. 71. Atlas.

Fig. 72. Axis.

The honeycomb-like structure, or "intermediate substance" previously described, in the Corvisart whale, as presented in the basal aspect of the auxiliary plates, developed on the inner side of the baleen, is to be seen in the young specimen, and may be identified by means of a hand magnifier in the photograph. The plates are horn-coloured, darkening to the outer edges, so that, viewed externally, the series appears to be black in its upper half, fading downwards, the lower

third of each plate being yellowish-white, which is also the hue of the bristles developed on the whole inner surface of the series. In the picture of the Corvisart whale (pl. xxii) the baleen appears to terminate abruptly at its posterior part; this is probably the effect of either loss or shadow, for in the Port Wakefield specimen, though far less tapering than in front, the posterior aspect of the baleen is by no means so abrupt as may be indicated by the photograph of the large whale referred to. Attention may be drawn to the circumstance that Turner ([7]) regarded the black colour of the baleen and bristles as characteristic of *B. sibbaldi*, and stated that the plates of *B. musculus* are customarily mottled brown, greyish, or greyish-yellow, with the bristles white or greyish-white. In a foetus of the former species he described the colour of the baleen

Fig. 73. First dorsal vertebra.

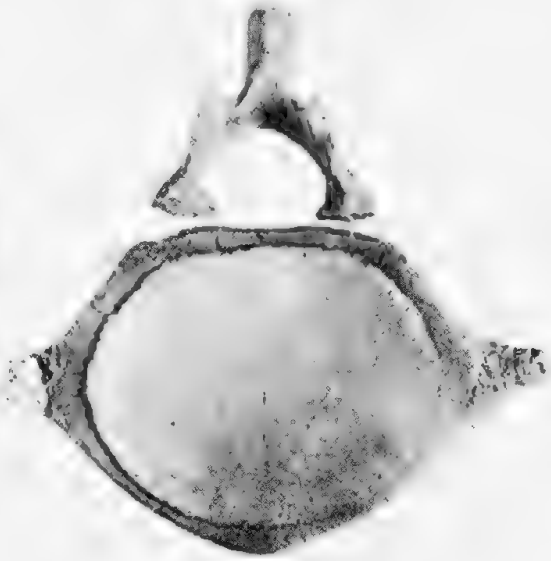


Fig. 74. First lumbar vertebra.

as slate-grey, the bristles cream coloured. As the two names are now usually regarded as applicable to the same species, it may be that in young examples the baleen and bristles are light coloured, and that they darken with age, becoming black in adults.

Vertebrae. From what we were able to preserve of the vertebrae it is evident that, in the young animal, examination should be made as early after death as possible. As previously mentioned, the whale in question had been dead some weeks before we were able to examine it, and in consequence the cartilaginous portions had dissolved into the general mass. This was especially noticeable in regard to the vertebrae, and the photographs here reproduced, which show little trace of dorsal or transverse processes, could scarcely have been identified had not care been taken to preserve their relative sequence.

(7) Turner, Marine Mammals in Anat. Mus. Edin., 1912, p. 40.

As noted by Owen ([8]), in a young *Balaena australis*, the cervical neurapophyses of one side are disunited from those of the other side, as they are from the centrum below. This condition is well seen in our specimen of *Balaenoptera*, the atlas and axis of which are respectively illustrated in figs. 71 and 72. The statement is also applicable to the first three dorsal vertebrae; thereafter the

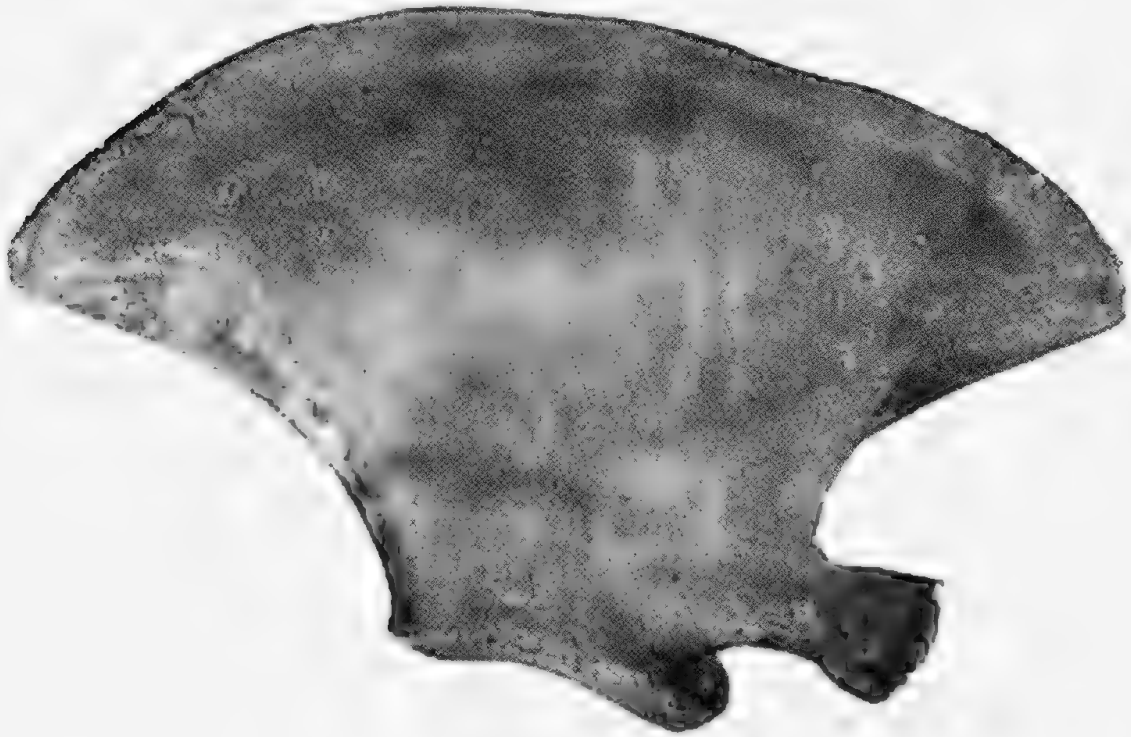


Fig. 75. Scapula.

neurapophyses are united by the development of the neural spine, but in no component of the entire vertebral column is the neural element united with the centrum. The first dorsal vertebra is shown in fig. 73, and the first lumbar in fig. 74. These illustrations may be respectively compared with those of the adult previously referred to. The number of vertebrae preserved is as follows, but one or two of the terminal elements may have been lost; Cervical, 7; dorsal, 14; lumbar, 14; caudal, 26; total, 61.

Limbs. Apart from size and texture, the scapula (fig. 75) differs little from that of the adult, the anterior edge is concave instead of convex, the acromion process is relatively short, while the coronoid is represented by a tumidity only. Whereas the scapular, limb bones, and phalanges are represented by porous bony structure, the carpals are cartilaginous, and are differentiated

(8) Owen, Anat. of Vert., ii, 1866, p. 418.

only by fibrous lines, which mark off the several ultimate elements. These lines may be traced in the illustration (fig. 76), reproduced from an actual photograph, which shows the phalanges to be composed as follows:

I, 0; II, 4; III, 6; IV, 6; V, 4.

It is possible, however, that some of the digits are incomplete, and there is no trace of Kukenthal's "digit iii". At no time easy to find, no trace of pelvic elements could be discovered in the putrid flesh.

Fig. 76. Fore limb.

Ribs. The number of ribs in the blue whale varies: there are usually either fifteen or sixteen pairs. In the Port Wakefield calf there are only fourteen pairs; their respective lengths are as follows:

Rib.		Metres.	Rib.		Metres.
1	...	·425	8	...	·780
2	...	·661	9	...	·745
3	...	·755	10	...	·707
4	...	·816	11	...	·680
5	...	·829	12	...	·644
6	...	·839	13	...	·637
7	...	·829	14	...	·666

By comparing these figures with those supplied for the Corvisart whale, it is interesting to find that the ratio of increase or decrease in length is maintained, thus successive increase takes place to the sixth rib, whence the decrease is regular to the thirteenth, the length of which is exceeded by the fourteenth.

Preservation. When first removed from the body, the bones were very soft and spongy, and the several components, as those of the skull for example, fell

apart. On drying they became so friable that the mere passage of a finger caused crumbling of the surface. In order to reassociate the bones they had to be relaxed, "treated", joined up, and again dried. The treatment consisted in painting the bones with a hot, weak solution of white (not "pale") Russian glue; the surface was thereby hardened, and reasonable handling became possible. Owing to the extreme porosity of the bones, dipping would have been impracticable.

AN AQUATIC ONISCID (CRUSTACEA)

BY W. H. BAKER, HON. CURATOR OF CRUSTACEA

Summary

Mr Herbert M. Hale, of the South Australian Museum, who first noticed this species in the "Pool of Siloam", at Beachport, South Australia, supplies the following note:
"The 'Pool of Siloam' is a small, isolated lake, lying a little distance from the coast, and surrounded by sandhills. The water is at all times much salter than the sea, and is said to be beneficial to bathers suffering from rheumatism and other ills – hence the name. The aquatic Philoscia was obtained in January, 1920, on the bottom, or slightly buried in the sand, in about six feet of water, well away from the shore. Great numbers were present in this situation, but no specimens were found under the debris on the banks, although they were searched for there. The water in which the crustaceans were living was tested by the South Australian Government Analyst, who supplied the following details: Specific gravity, 1.078 at 60 degrees F.; dissolved solids, 7,614 grains to gallon, of which 6,749 grains is common salt (over three times as salt as the sea). Numbers of Ostracods, a small red species of Cyclops, and some water-beetles were also present in the 'lake'." Specimens collected by Mr. Hale are much beset with stalked infusorians.

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Text fig. 77.

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Since the above date Mr. S. S. Stokes, on request, searched the "Pool of Siloam" during three separate visits to Beachport; two years after the first examples were obtained no specimens were found in the lake, but in 1924, and again in January of 1926, good series were captured. On the last occasion Mr. Stokes was informed by local residents that the same crustacean occurs in other salt swamps near Beachport.

The following is a description of the animal:

PHILOSCIA SALINA sp. nov.

There are the usual outstanding characters of the genus; the side-plates of the abdomen are, however, a little more outward projecting than usual. The body is sparsely beset with minute spinules, which are regularly arranged on the posterior margins of segments; also there are very many minute black spots irregularly arranged in longitudinal groups on the dorsal surface, otherwise the colour is pale.

The head is short, with two faint median lobes on the forehead. The eyes are moderate in size, lenticular, of about 26 ocelli. The minute antennule consists of a stout basal joint, the 2nd joint narrowing distally, while the 3rd is very narrow. The antenna is short, the joints are clothed with minute spinules, its

flagellum is only a little longer than the 5th peduncular joint, the three joints of the flagellum are short, the 1st and 3rd subequal, the middle one a little shorter. The left mandible has a 3-toothed incisory plate, a 5-toothed secondary

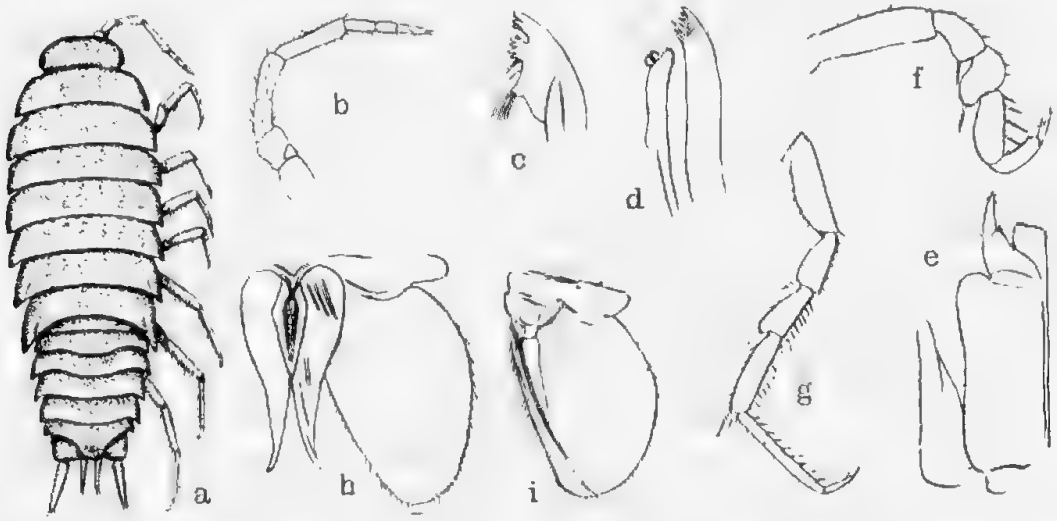

Fig. 77. *Philoscia salina*, male; *a*, dorsal view; *b*, antenna; *c*, left mandible; *d*, first maxilla; *e*, maxilliped; *f* and *g*, first and seventh legs; *h* and *i*, first and second pleopods.

plate, with tuft of setae just below, then a single setum followed by the fascicle of setae which represent the molar process. In the right mandible the secondary plate is much smaller. The segments of thorax are subequal in length. Faint lateral lines mark off the epimera on the more posterior ones. The 6th segment of abdomen is a little excavate on its upper surface, and is obtusely pointed at the end. The 1st four pairs of legs are prehensile, that is, the propodus and dactylus are curved and capable of closing on the carpus. In the female the 4th pair has less prehensile character. In the 1st pair, which are shortest, the basos is the longest joint, the ischium short, the merus broader than long, the carpus about the same length as propodus and dactylus together: these joints are sparely spined. In the remaining pairs the spines are more numerous. The 7th pair is very long. The pleopods, owing to the large opercular exopods, are very conspicuous. The 1st has the exopod fringed with delicate cilia, the endopod being modified into an *appendix masculina*, broad at base and slightly turned outwards at apex. The second pleopod also has the exopod fringed with cilia, especially on the inner side; the endopod is modified into a secondary sexual appendage, which is broad at base and tapers to a very fine end, reaching to the length of the exopod. The endopods of the succeeding pairs are short and fleshy. The 5th pair is smaller. In all the pleopods the peduncles are well developed. The uropods are short, with broad peduncles reaching a little beyond end of abdomen. The outer rami are awl-shaped and slender, the inner are also awl-shaped and shorter than the outer.

Length, 11 mm.; breadth, 4½ mm.

Type, male, in South Australian Museum, Reg. No. C. 792.

ON THE GENUS MANDALOTUS (COLEOPTERA, CURCULIONIDAE)

BY ARTHUR M. LEA, F.E.S., ENTOMOLOGIST, SOUTH AUSTRALIAN MUSEUM

Summary

The genus Mandalotus now consists of a greater number of species than any other of Australian weevils; and although thirty-eight new ones are now added, it is certain that many more remain to be taken. These beetles occur in abundance in the coastal and forest districts of Queensland, New South Wales, Victoria and Tasmania, and extend rather sparsely into South Australia; several are herein added from Lord Howe and Norfolk Islands. A few were recorded from Western Australia, but these have all been transferred to Timareta. Many have been taken on mountains, including their summits, in tussocks, in moss, under leaves, and under logs and stones, and several occur at the roots of beach-growing plants. During floods they may often be obtained in abundance.

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Mr. F. Erasmus Wilson has been recently keenly searching moss, tussocks, and fallen leaves, and has taken many new Victorian species, including several of great interest. Hardly any Australian weevil, for instance, has such remarkable legs as the male of *M. insignipes*. Mr. A. H. Elston has also taken some interesting species from South Australia.

Owing to the unattractive appearance of most of the species (often enhanced by dried mud), their sluggish habits, and the skill needed in obtaining them, they are usually passed over by collectors. At least two species, *M. avenaceus* and *M. crawfordi*, are destructive to growing grain, but being nocturnal they are rarely seen.

The characters of the under surface and legs are usually of greater specific import than those of the upper surface, and to see them clearly no abrasion is needed; but some manipulation is usually required to see the armature (when present) of the coxae and tibiae, and a small amount of dirt may easily obscure parts of the sterna and abdomen. On the other hand, to see certain details of the upper surface it is usually necessary to remove some of the scales. On almost all species of the genus there is a row of large punctures, following at a short distance the outline of the basal segment of abdomen; and another following the outline of the front of the metasternum, and usually easily traceable on the most densely clothed specimens. As they are so constant they have seldom been noted in the descriptions.

The females of but few species are distinct, and I have seldom associated

them with males, unless taken from the same localities; even many males are so strikingly alike, in general appearance, that they cannot be distinguished by the upper surface alone; there is, however, no other large genus of weevils in which the males may be so readily identified by the characters of the under surface and legs. In mounting single specimens it is therefore desirable that they should be placed on their sides, so that both surfaces may be examined.

In collections they are frequently associated with other genera which they strongly resemble, but from which they may be distinguished as follows:

Essolithna. Has a single claw to each foot.

Polyphrades. Has claws soldered together at base.

Timareta. Has no ocular lobes. Several species with ocular lobes were referred to *Dysostines* by Pascoe and Blackburn, and to *Mandalotus* by myself, but these have all been transferred to *Timareta.*

The New Zealand genus *Catoptes* is nearly allied, but the species have less rounded eyes; at present it includes some with ocular lobes and others without such. *Notiopatae sternalis* Broun, also from New Zealand, is very close to several species, but is without ocular lobes.

It is probable that future workers will break up the genus; but I am satisfied that the great variation in the separation of the front coxae is of specific value only, as the finest gradations occur between species in which the coxae touch and others in which they are widely separated. Pascoe and Blackburn both noted the variation in the distance separating the coxae as an unusual generic feature. The armature of the sternum and legs, and the processes on the abdomen, are all confined to the males. The species of the group (H of the table) with very thick scape, however, differ but little sexually, and that character might fairly be regarded as entitling them to generic rank.

References to the genus and species are as follows:

ERICHSON. *Wiegm. Arch., 1842, p. 193.*

Mandalotus named, referred to Otiorhynchides and four species described, *M. crudus* being the first.

LACORDAIRE. *Gen. Coleopt., vi., p. 231.*

Genus referred with doubts to Eremnides.

PASCOE. *Journ. Linn. Soc. Zool., x, 1870, p. 472.*

Dysostines named, referred to the Rhyparosomides, and one species described.

Trans. Ent. Soc., Lond., 1870, p. 455.

Four species of *Dysostines* named.

Ann. Mag. Nat. Hist., xii, 1873, p. 232.

One species of *Dysostines* named.

MASTERS. *Cat. Aust. Col.*

Mandalotus referred to Eremnides, 4487-4490.

Dysostines referred to Rhyparosomides, 4943-4948.

BLACKBURN. *Proc. Linn. Soc., N.S. Wales, 1890, p. 314.*

Notes on *Dysostines* with four species named.

Id., 1892, p. 127.

Two species of *Dysostines* named.

Trans. Roy. Soc. S. Austr., 1892, p. 229.

Dysostines recorded as a synonym of *Mandalotus.*

Id., 1901, p. 27.

Records examination of Erichson's types.

LEA. *Trans. Roy. Soc. S. Austr., 1904, p. 16.*

Twelve species of *Mandalotus* named.

Id., 1907, p. 130.

Notes on genus, now referred to Leptopsides, and on several species, with table, and thirty-five species named.

Id., 1909, p. 160.

Notes on genus and species, ten being named.

Id., 1911, p. 67.

Notes on several species, and nine named.

Id., 1912, p. 76.

Notes on several species, and five named.

Id., 1914, p. 297.

Notes on genus and species, with second table, and eleven named.

Id., 1916, p. 322.

Notes on several species and seven named.

Id., 1923, p. 358.

One species named.

Id., Proc. Roy. Soc. Vic., xx (n.s.), pt. 2, 1907.

One species named.

Id., Mem. Soc. Ent. Belge, xviii, 1910.

One species named.

Id., Proc. Linn. Soc., N.S. Wales, 1914, p. 659.

Three species named.

Id., 1916, p. 735.

Two species named.

KEY TO SPECIES.

A. Middle of apex of basal segment of abdomen impinging on second.

a. Tip of impinging part shining and flat .. .. *sterilis*

aa. Tip bituberculate.
* Tubercles close together .. .. *squalidus*
** Tubercles rather widely separated .. .. *insularis*
AA. Middle of apex of basal segment incurved or almost straight.
B. Prosternum tuberculate.
b. Tubercle behind coxae .. .. *prosternalis*
bb. Tubercle in front of coxae
c. Tubercle longitudinal .. .. .. *hoplosternus*
cc. Tubercle transverse .. .. *armipectus*
BB. Prosternum not tuberculate.
C. Mesosternum with a projecting intercoxal process.
d. Process bifid.
e. Apex of process its widest part .. .. *laminipectus*
ee. Apex narrower than middle.
f. Front tibiae terminating in a thin flange .. *laminatipes*
ff. Front tibiae terminating in a spur.
g. Size less than 4 mm. .. .. .. *uniformis*
gg. Size more than 4 mm. .. .. .. *incisus*
dd. Process a truncated lamina.
h. Process longer than middle coxae.
i. Process narrower at apex than across middle .. .. *intercoxalis*
ii. Process of even width from apex to near base .. .. *hoplostethus*
hh. Process shorter than middle coxae.
j. Elytra trisinuate at base .. .. .. *simulator*
jj. Elytra conjointly arcuate at base
k. Front tibiae flattened and shining internally .. .. *carinatipes*
kk. Front tibiae not flat or shining there *niger*
ddd. Process conical in front.
l. Prothoracic granules transversely arranged.
m. Front tibiae with several distinct teeth on lower surface .. .. .. *pyrifer*
mm. Front tibiae without such .. .. *mesosternalis*
ll. Prothoracic granules not transversely arranged.
n. Hind tibiae dentate at middle .. .. *erudus*
nn. Hind tibiae not so armed.
o. Hind tibiae widest near and suddenly narrowed at base .. .. .. *rudis*
oo. Hind tibiae normal at base.
p. Elytral setae fairly long and not in single series .. .. .. *variabilis*
pp. Elytral setae not as in *variabilis*.
q. Mesosternal process not projecting beyond coxae .. .. .. *vacillans*
qq. Mesosternal process projecting beyond coxae.
r. Prothoracic granules concealed before abrasion .. .. *auchmeresthes*

rr. Prothoracic granules fairly distinct before abrasion .. *pentagonalis*

CC. Mesosternum with intercoxal process not projecting.

D. Abdomen tuberculate.

s. Basal segment without tubercle, but second with two.

t. Tubercles as close to sides as to each other .. *setistriatus*

tt. Tubercles much closer to each other than to sides.

u. Small and thin, and front coxae not very widely separated .. .. .. *tenuis*

uu. Large and robust, and front coxae widely separated .. .. *amplicollis*

ss. Basal segment with one tubercle.

v. Prothoracic granules transversely arranged *bimaculatus*

vv. Prothoracic granules not transversely arranged.

w. Second segment also tuberculate .. .. *emarginatus*

ww. Second not tuberculate.

x. Tubercle submedian ... . *tuberculiventris*

xx. Tubercle apical .. .. *bivitticollis*

sss. Basal segment with two tubercles.

y. Tubercles not at extreme tip.

z. Front coxae touching .. .. .. *geminatus*

zz. Front coxae widely separated.

a. Distance between tubercles more than length of second segment in middle .. *glaber*

aa. Distance less .. .. *decipiens*

yy. Tubercles at extreme tip.

b. A wide depression between tubercles .. *taylori*

bb. Without such a depression.

c. Front coxae feebly separated .. .. *murrayi*

cc. Front coxae conspicuously separated

d. Alternate interstices of elytra elevated .. .. *latens*

dd. Alternate interstices not elevated .. *lutosus*

DD. Abdomen carinate.

e. A longitudinal carina on each side of middle of basal segment.

f. Prothoracic granules transversely arranged *excavatus*

ff. Prothoracic granules not transversely arranged .. .. *armivarius*

ee. A transverse or curved carina on basal segment.

g. Front coxae touching, or apparently so.

h. All tibiae deeply notched .. .. .. *insignipes*

hh. All tibiae not notched.

i. Basal segment of abdomen straight in middle of apex.

j. Base of elytra trisinuate .. .. *bryophagus*

jj. Base of elytra evenly arched .. *litoralis*

ii. Basal segment somewhat incurved at middle of apex.
k. Elytra with conspicuous tubercles about summit of apical slope.. *denticulatus*
kk. Elytra without tubercles there.
l. Hind tibiae dentate about middle *advenus*
ll. Hind tibiae not dentate about middle .. .. .. *brevicarinatus*
gg. Front coxae distinctly and usually widely separated.
m. Carina not touching middle of apex of segment.
n. Carina strongly elevated and inclined forwards .. .. *severini*
nn. Carina quite straight .. .. *recticarinatus*
nnn. Carina distinctly curved.
o. Elytra tuberculate about summit of apical slope .. .. .. *arciferus*
oo. Elytra not tuberculate there.
p. Female with a conspicuous interocular tubercle .. *interocularis*
pp. Female without such .. *carteri*
mm. Carina with its middle touching apex of segment.
q. Hind tibiae (except at tip) not dentate or denticulate.
r. Second abdominal segment also carinate .. .. .. *magnicollis*
rr. Second not carinate.
s. Carina with a row of punctures .. .. .. *longicollis*
ss. Carina impunctate .. .. *blackburni*
qq. Hind tibiae dentate or denticulate.
t. Second segment feebly carinate *bicarinatus*
tt. Second segment not carinate.
u. Intercoxal process of mesosternum narrower than distance between middle and hind coxae.
v. Granules of basal segment of abdomen unusually conspicuous .. .. *granulatus*
vv. Granules of basal segment small and inconspicuous.
w. Scutellum small and shining .. .. *sabulosus*
ww. Scutellum not traceable .. .. .. *sydneyensis*
uu. Intercoxal process at least as wide as distance between middle and hind coxae.
x. Very small .. .. *minutus*

xx. Of moderate size.
y. Surface near carina with crowded punctures and no granules.
z. Apex of basal segment of abdomen evenly arched .. *punctiventris*
zz. Apex rather suddenly incurved at middle .. .. *hystricosus*
yy. Surface near carina with granules as well as punctures.
a. Elytral suture with small shining granules .. *fuligineus*
aa. Without such granules .. .. *imitator*
DDD. Abdomen neither tuberculate nor carinate.
E. Metasternum bituberculate .. .. *metasternalis*
EE. Metasternum not bituberculate.
F. Elytra tuberculate.
b. Hind tibiae dentate at base .. .. .. *scaber*
bb. Hind tibiae not dentate there.
c. Front coxae touching, or almost so.
d. Sides of prothorax bilobed.
e. Shoulders conspicuously produced .. .. *bilobicollis*
ee. Shoulders rounded off .. .. *vigilans*
dd. Sides of prothorax not bilobed.
f. Size moderate .. .. .. *hypulus*
ff. Size minute.
g. Elytral tubercles with conspicuous setae .. .. *norfolcensis*
gg. Elytral tubercles without such .. .. .. *nodipennis*
cc. Front coxae widely separated.
h. Middle coxae almost as widely separated as hind ones .. .. .. *campylocnemis*
hh. Middle coxae much closer together.
i. Under surface with dense and long hairs .. .. *mirabilis*
ii. Under surface without such.
j. Sides of prothorax bilobed .. *collaris*
jj. Sides not bilobed.
k. Shoulders separately and suddenly produced .. *ferrugineus*
kk. Shoulders not produced except with even arcuation of base.
l. Hind tibiae suddenly and strongly incurved at apex .. .. .. *valgus*

ll. Hind tibiae not as in *valgus.*
m. Elytra conjointly arcuate at base .. *funereus*
mm. Elytra trisinuate at base.
n. Hind tibiae strongly narrowed on inner side between middle and apex .. *coatesi*
nn. Hind tibiae not strongly narrowed there .. *irrasus*

FF. Elytra non-tuberculate (at least elsewhere than near shoulders).
G. Prothoracic granules transversely arranged or subcarinate, or multicarinate.
o. Middle coxae ridged or dentate.
p. Hind tibiae dentate at basal third .. *medcoxalis*
pp. Hind tibiae not dentate there.
q. Front tibiae distinctly notched on one side of apex .. .. .. *dentipes*
qq. Front tibiae not so notched .. .. *oxyomus*
oo. Middle coxae not armed.
r. Hind tibiae subdentate near base .. .. *trisinuatus*
rr. Hind tibiae not subdentate there.
s. Basal segment of abdomen with a polished semicircular space .. .. *abdominalis*
ss. Basal segment without such a space.
t. Shoulders acutely produced forwards .. .. *acutangulus*
tt. Shoulders not so produced.
u. More than 3 mm. in length.
v. Derm of abdomen not concealed by clothing .. *crawfordi*
vv. Derm of abdomen more or less concealed.
w. Apical slope of elytra subtuberculate .. .. *transversus*
ww. Apical slope not subtuberculate .. .. *setosus*
uu. At most 3 mm. in length.
x. Abdominal clothing not concealing derm .. .. *multicarinatus*
xx. Abdominal clothing normally concealing derm.
y. Without a posthumeral tubercle or swelling .. *striatus*

yy. With such.
z. Interstices of elytra even — *arcuatus*
zz. Alternate interstices feebly elevated.
a. Width of elytra at summit of apical slope as great as at base .. .. — *latebricola*
aa. Width there less .. — *subhumeralis*

GG. Prothoracic granules not transversely arranged.
H. Scape very stout.
b. Pronotum with large, isolated granules .. — *nodicollis*
bb. Pronotum with denser and smaller granules.
c. Base of rostrum suddenly elevated .. — *ammophilus*
cc. Base not suddenly elevated.
d. Elytra with an interrupted post-median pale fascia .. .. — *herbivorus*
dd. Elytra without such a fascia.
e. Less than 4 mm. in length .. — *pondericornis*
ee. More than 4 mm. in length .. — *crassicornis*

HH. Scape at most moderately stout.
I. Hind tibiae armed .. .. — *fergusoni*
II. Hind tibiae not armed.
J. Front coxae touching.
g. Antennae unusually long and thin .. — *tenuicornis*
gg. Antennae normal.
h. Hind tibiae conspicuously fringed with long hairs in both sexes .. .. — *inusitatus*
hh. Hind tibiae not so fringed.
i. Prothorax, even after abrasion, without conspicuous granules.
j. Fairly large .. .. .. — *howensis*
jj. Small.
k. Elytra fully twice as long as wide — *inconspicuus*
kk. Elytra less than twice as long as wide.
l. Eyes smaller, and with larger facets than usual .. .. — *puncticollis*
ll. Eyes normal .. .. .. — *squamibundus*
ii. Prothorax, at least after abrasion, with conspicuous granules.
m. Distance between eyes less than width of an eye .. .. — *macrops*
mm. Distance between eyes more than width of an eye.
n. Elytra maculate.
o. Sides of elytra parallel for part of their length .. — *maculatus*
oo. Sides of elytra nowhere parallel .. .. .. — *cordipennis*

nn. Elytra inconspicuously or not at all maculate.
p. Elytral clothing more or less rough.
q. A conspicuous prominence between scutellar region and each shoulder .. .. *microps*
qq. Without such .. .. *coxalis*
pp. Elytral clothing evenly plating surface.
r. A polished, deep cavity on abdomen and metasternum .. .. *gymnogaster*
rr. Depression shallower and not polished.
s. At least 4 mm. in length *alpinus*
ss. Less than 4 mm. .. *muscivorus*
JJ. Front coxae distinctly and usually widely separated.
K. A sudden and deep cavity common to metasternum and abdomen .. .. .. *foveatus*
KK. Cavity, if present, not both sudden and deep.
L. Granules in middle of pronotum with setae only.
t. Basal segment of abdomen without granules, size small .. .. *reticulatus*
tt. Basal segment with granules, size larger.
u. Elytral granules apparently confined to suture .. .. .. *seticollis*
uu. Elytral granules visible elsewhere before abrasion .. .. *caviventris*
LL. Granules (if present) both setose and squamose.
M. Hind coxae armed .. .. .. *postcoxalis*
MM. Hind coxae unarmed.
N. Front coxae much more widely separated than middle ones .. .. *hoplocnemus*
NN. Front and middle coxae widely and almost (or quite) equally separated.
v. Middle coxae armed .. .. *tibialis*
vv. Middle coxae unarmed.
w. Metasternum and basal segment of abdomen densely pilose .. .. .. *piliventris*
ww. Under surface not densely pilose .. .. .. *raui*

NNN. Front coxae less widely separated than middle ones.
O. Front tibiae strongly dentate towards base .. .. *avenaceus*
OO. Front tibiae denticulate at most.
P. Minute.. .. .. *microscopicus*
PP. At least 3 mm. in length and usually much more.
Q. Elytra distinctly trisinuate at base *humeralis*
QQ. Elytra scarcely, if at all, trisinuate at base.
R. Suture, on abrasion, distinctly paler than adjacent parts .. *suturalis*
RR. Suture not paler.
S. Elytra with scales only .. .. *squamosus*
SS. Elytra with scales and setae ..
T. Intercoxal process of mesosternum wider than coxae .. *rufimanus*
TT. That process narrower than coxae.
U. Hind tibiae suddenly thinned from about the middle .. *cellaris*
UU. Hind tibiae not as in *cellaris*.
V. Prothorax, on abrasion, with very minute granules.
x. Ciliation of front tibiae rather dense and long *similis*
xx. Ciliation shorter and much sparser .. *ochreonotatus*
VV. Prothorax, on abrasion, with large but almost obsolete granules.
y. Derm normally almost flavous .. .. *pallidus*
yy. Derm normally much darker .. .. *blackmorei*
VVV. Prothorax, on abrasion, with ordinarily distinct granules.
W. Abdomen almost glabrous.. *subglaber*
WW. Basal segment squamose and setose in middle.
z. Ciliation of front tibiae long and fairly dense *ciliatus*
zz. Front tibiae with sparse and rather long setae, but not ciliate *angustus*
WWW. Basal segment setose only in middle.
X. Prothorax as wide as elytra *albonotatus*

XX. Prothorax narrower than elytra.
Y. Depression of abdomen confined to basal segment .. .. .. *spureus*
YY. Depression continued on to second segment .. *angustipictus*

NOTES ON KEY.

As in previous tables, the present one deals with males, except that *M. carteri* and *M. interocularis* are separated by their females. It does not appear possible to give a table of females by which most of those known may be identified with certainty, and many were not described, as it was found impossible to associate them with their appropriate males.

The transverse arrangement of the prothoracic granules of many species is generally quite conspicuous before abrasion, and is usually due to some of the granules being placed in irregular transverse rows, rather than more or less closely compacted; but the character alters, till on some species the surface, after abrasion, is seen to be traversed by numerous fine and quite sharply defined carinae, which may or may not be interrupted; on *M. crawfordi* and *M. multicarinatus*, in particular, they are very distinct. On several species there is a faint indication of transverse arrangement on the sides only, but this has not been considered as warranting the species being placed with those having the transverse arrangement present.

In the 1914 table some of the species were associated as having "Front coxae more or less widely separated", as against "Front coxae not widely separated", the latter being again divided into those in which the coxae were in actual contact and those in which they were slightly separated. As these divisions were not always easy of application, the main ones now used are those in which the coxae are in actual contact, and those in which they are distinctly, and usually very conspicuously separated. As the front coxae of the males are often slightly larger than those of the females, their distance apart is sometimes slightly less than in the females.

C. *p*. On *M. variabilis* the elytra, when viewed from behind, are seen to have the clothing rather dense; the other species, when so viewed, appear to have stouter setae, mostly in single series.

D. *x*. On *M. tuberculiventris* the tubercle might be fairly regarded as a short carina.

DD. *ff*. On *M. armivarius* the abdomen might be regarded as having the abdomen tuberculate, instead of carinate; if so regarded it could be associated with *M. glaber* and *M. decipiens*, two much larger and shining species.

DD. *g*. In the 1914 table four species with carinated abdomen were associated by "Front coxae feebly separated". Of these *M. litoralis* really has the front coxae touching, although owing to a slight amount of dirt this was not evident on the type. On *M. advenus* the separation is so slight that they might fairly be regarded as touching. On *M. bicarinatus* and *M. blackburni* they are separated less widely than on most species of DD. *gg*, but the separation is quite distinct.

DD. *r*. In the table *M. magnicollis* and *M. blackburni* are separated by characters of the abdomen; on one male of *blackburni* there is a slight abrasion of the second segment, as a result of which a shining line might be considered a carina; but on *magnicollis* the carina on the second segment is curved, and much more distinct than that on the basal segment.

DD. *uu*. The middle and hind coxae are at their closest in a somewhat oblique direction; the species associated here also have their front coxae unusually widely separated.

DD. *zz*. The curved carina, at first glance, appears to have its middle some distance from the apex of the basal segment of the abdomen, but on close examination the suture is seen to be rather suddenly incurved at its middle, so that the hind margin of the segment is really partly formed by the carina.

G. On all species the front coxae are distinctly and usually widely separated.

G. *s*. Not a carina, but a flat space, arched at its posterior end.

G. *t*. On this species the transverse arrangement of the granules is less conspicuous than on others of G.

G. *u*. The lengths given are exclusive of the rostrum.

G. *xx*. The abdomen of the type of *M. arcuatus* has been partly abraded, as is evidenced by the dense clothing of the non-abraded parts.

GG. On the sides of some species a slight transverse arrangement of the granules may be traced, but this is not continued across the disc, as on the species of G.

H. On all the species the front coxae are touching.

H. *b*. The granules are often concealed by dried mud, and a certain amount of abrasion is needed to see them clearly, even on specimens in good condition.

I. This does not refer to the apical spur, present on all species of the genus.

I. *f* and *ff*. Not used in table.

J. *n*. On specimens in poor condition the spots are more or less obliterated.

J. *r*. On the two following species the abdomen is depressed, but there is not a specially deep polished black space along the middle.

K. On *M. cuviventris*, and several other species, the depression on the under surface is large, but is shallow posteriorly.

NNN. On *M. rufimanus*, and several other species, the front coxae are quite evidently separated, the middle ones still more conspicuously so.

Names that have been used in *Mandalotus* or *Dysostines*, but are not included in the table, are as follows:

carinativentris Lea	= *fuligineus* Pasc.
imponderosus Lea	Only female known.
latus Lea	Only female known.
pilipes Pasc.	Now *Timareta*.
pilosus Blackb.	Now *Timareta*.
pinguis Lea	Now *Timareta*.
pusillus Lea	Now *Timareta*.
pustulosus Pasc.	= *T. pilipes* Pasc.
rigidus Er.	= *crudus* Er.
rufipes Lea	Only female known.
ventralis Blackb.	= *sterilis* Er.
vetulus Er.	= *sterilis* Er.
wedgensis Lea	= *punctiventris* Blackb.

MANDALOTUS STERILIS Er.

Fig. 78 a.

In the original diagnosis of *Mandalotus*, and of the four species attributed to it, Erichson never even mentioned the abdomen. On examination of the type, however, Blackburn (1) said that of *M. sterilis*, which he presumed to be a male, "the suture between the first and second ventral segments is extremely fine, and the segments themselves on the same plane"; and stated that he considered *M. vetulus* to be its female. He also considered that *Dysostines fuligineus* was a synonym of *sterilis*. Subsequently (2) I commented on some specimens as probably sexes of *sterilis*, and in 1914 included them in the table under that name. These specimens, however, are certainly all females of *M. ventralis*. The species occurs commonly at the roots of beach-growing plants in Tasmania, Victoria, and South Australia, and I have examined hundreds of specimens of both sexes. The male is distinct by the basal segment of the abdomen having its middle largely encroaching on the second segment, with the encroachment highly polished; the markings of the upper surface vary considerably, and the length (without the rostrum) varies from 4 to 8 mm. The female, in addition to many other sexual distinctions, has the suture between the two basal segments of abdomen very faint, except at the sides, and is the only female in the genus known to me in which it is not distinct throughout. I am now fully convinced that the type specimens commented upon by Blackburn as sexes of one species

(1) Blackburn, Trans. Roy. Soc., S. Austr., 1901, p. 27.

(2) Lea, *l.c.*, 1907, p. 136.

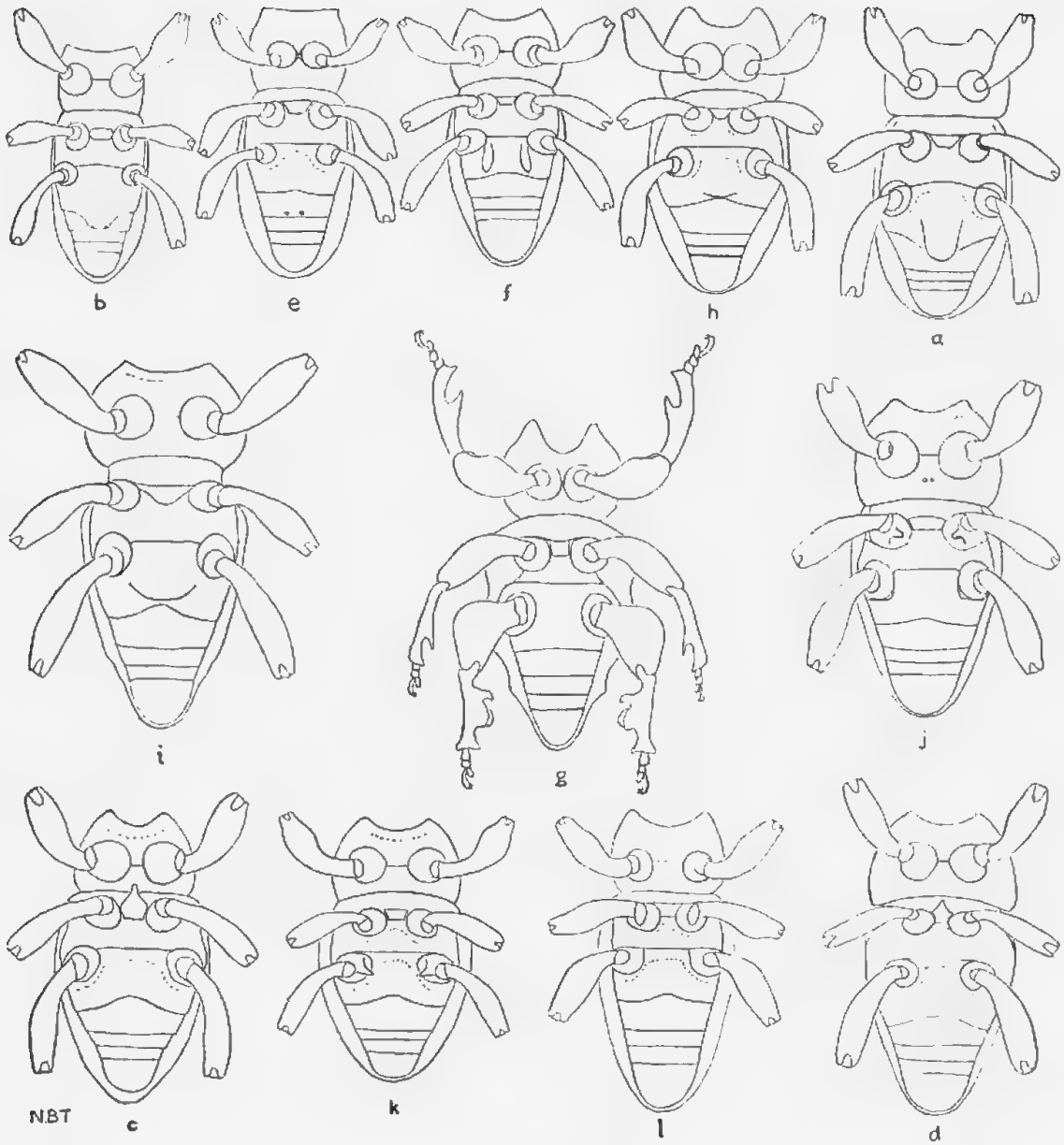

Fig. 78. a, Under surface of *Mandalotus sterilis* Er; b, of *M. squalidus* Lea; c, of *M. pyrifer* Lea; d, of *M. auchmeresthes* Lea; e, of *M. tenuis* Lea; f, of *M. armivarius* Lea; g, of *M. insignipes* Lea; h, of *M. brevicarinatus* Lea; i, of *M. hystricosus* Lea; j, of *M. medcoxalis* Lea; k, of *M. postcoxalis* Lea; l, of *M. hoplocnemus* Lea.

(*sterilis* male and *vetulus* female) are really both females of *ventralis*, and that the specimens I commented upon as sexes of *sterilis* are also all females of *ventralis*. Blackburn's conjecture that *Dysostines fuligineus* is a synonym of *sterilis* is incorrect; the male of *fuligineus* has a conspicuous carina on the basal segment of the abdomen, and is the species I subsequently named *carinativentris*.

although on commenting on some British Museum specimens of *fuligineus* (3) I was still under the impression that the abdomen was simple in both sexes of *sterilis*. The synonymy of these species is therefore as follows:

M. sterilis Er.
M. vetulus Er.
Dysostines ventralis Blackb.
M. fuligineus Pasc. *(Dysostines).*
M. carinativentris Lea.

MANDALOTUS PUNCTIVENTRIS Blackb.

Fig. 80, a.

M. wedgensis Lea.

In commenting upon a cotype male of *M. punctiventris*, on a previous occasion (4), I stated that a curved line on the basal segment of the abdomen could hardly be considered as a carina; on re-examination, and on comparison with the type of *M. wedgensis* (unfortunately now to be recorded as a synonym of it), it appears to be slightly variable in its elevation; in the accompanying table it is now placed with those having the abdomen carinated. The comments upon the armature of the middle tibiae should have been upon the hind ones.

MANDALOTUS INTERCOXALIS Lea.

Fig. 80, y.

The hind coxae of this species are armed somewhat as in *M. postcoxalis*, from which it is at once distinguished by the intercoxal process of the mesosternum.

MANDALOTUS CARTERI Lea.

Five specimens, taken at an elevation of 5,000 feet on Mount Kosciusko, differ from the type in having the legs and sterna less hairy, and the prothoracic granules less distinct, both before and after abrasion.

MANDALOTUS LONGICOLLIS Lea.

Three females, taken with a male at an elevation of 5,000 feet on Mount Kosciusko, differ from it in being shorter and more compact, the abdomen shorter and more convex, its basal segment non-carinate, and all the tibiae simple.

(3) Lea, *l.c.*, 1911, p. 75.
(4) Lea, *l.c.*, 1914, p. 304.

MANDALOTUS SQUALIDUS Lea.

Fig. 78, b.

In the original description of this species the second segment of the abdomen was described as having two small tubercles in the middle, and the species was placed in the 1914 table of the genus in a position based on that supposed character. The type, however, was somewhat dirty, and on examination of fresh specimens from Quorn and Peterborough it became evident that the tubercles are really on the basal segment, the apex of this being strongly produced in the middle, somewhat as on the male of *M. sterilis (ventralis)*, although the two species are very unlike in other respects.

MANDALOTUS CRASSICORNIS Lea.

Three specimens from Stradbroke Island are smaller than usual, and their scales are pale ashen-grey, with faintly infuscated spots.

MANDALOTUS PONDERICORNIS Lea.

Fig. 80, v.

Four specimens, three males and one female, from Lakes Entrance (Victoria) evidently belong to this species. The male differs from the female in having the basal segments of abdomen quite flat or even faintly depressed, and with the intercoxal process of mesosternum feebly produced in front, although not conical. On one of the males there are several whitish spots scattered about on the elytra; on two of them the alternate interstices of the elytra are more noticeably elevated than on the others.

MANDALOTUS INUSITATUS Lea.

Fig. 80, b.

On preparing to draw a hind tibia of a specimen of this species, Mr. Tindale noticed that its left hind tarsus was distinctly five-jointed, the others all being normal.

MANDALOTUS PUSILLUS Lea (now TIMARETA).

On floating off the type of this species for re-examination, it was found that the apex of the prosternum is scarcely incurved in the middle, and that the ocular lobes are entirely absent. It is therefore a *Timareta*.

MANDALOTUS ADVENUS Blackb. Fig. 80, c.

M. ARMIPECTUS Lea. Fig. 80, x.

M. BLACKMOREI Lea. Fig. 80, s.

M. CARINATIPES Lea. Fig. 80, d.

M. CELLARIS Pasc. Fig. 80, e.

M. CRAWFORDI Blackb. Fig. 79, a.

M. CRUDUS Er. Fig. 79, b.

M. DENTIPES Lea. Fig. 80, n.

M. FERGUSONI Lea. Fig. 80, f.

M. GRANULATUS Lea. Fig. 80, g.

M. INTEROCULARIS Lea. Fig. 80, t.

M. LAMINATIPES Lea. Fig. 80, o.

M. LAMINIPECTUS Lea. Fig. 80, z.

M. MESOSTERNALIS Lea. Fig. 80, aa.

M. RUDIS Lea. Fig. 80, h.

M. SCABER Lea. Fig. 80, i.

M. SYDNEYENSIS Lea. Fig. 80, j.

M. TENUICORNIS Lea. Fig. 80, w.

Sketches of parts of these species are given for purposes of comparison, but it is to be noted that the appearance of the tibiae varies from almost every point of view.

MANDALOTUS INSULARIS sp. nov.

♂ Blackish-brown, antennae and parts of legs reddish. Densely clothed with muddy brown scales, interspersed with stiff, suberect setae.

Rostrum short and strongly curved; median carina traceable only at apex. Antennae not very thin. Prothorax moderately transverse, with small granules,

inconspicuous before abrasion. Elytra conjointly arcuate at base, shoulders oblique, a notch between each, and a distinct posthumeral prominence; with rows of large punctures, much wider than interstices, but appearing much smaller through clothing: interstices even. Basal segment of abdomen depressed in middle, with numerous fine lines and small punctures, its apex slightly impinging on second and with two small but distinct tubercles. Front coxae rather widely separated, tibiae spurred at apex. Length, 4 mm. The lengths given are exclusive of the rostrum.

Hab. Queensland: Stradbroke Island (H. J. Carter). Type (unique), I. 15986.

The middle of the basal segment of abdomen is slightly arched outwards, so that it really impinges on the second, although not by much; regarding it as such in the table it is associated with *M. squalidus*, from which it differs in being wider, the produced part less and with the tubercles almost as distant from each other as from the sides. Regarding it as belonging to D. of the table, it could be associated with *M. luteus* and *M. lutosus*, two much smaller species; *lutosus*, whose tubercles are about as far apart, is a thinner species, with more conspicuous prothoracic granules and scarcely evident posthumeral prominence; *luteus* is wider, with the basal segment of abdomen flat in middle, and its tubercles close together. From the side each tubercle appears as the abrupt ending of a short ridge, but from in front or behind each appears distinctly conical. The colour of the derm of the type is as described, but that of many species of the genus varies from reddish-brown to black.

MANDALOTUS UNIFORMIS sp. nov.

Fig. 80, bb.

♂ Blackish, antennae and tarsi dull reddish. Densely clothed with muddy-brown scales, and with stout, decumbent setae, on the elytra seriate in arrangement.

Rostrum moderately curved; median carina partly concealed. Antennae rather short. Prothorax moderately transverse, median line distinct; granules and punctures ill-defined through clothing. Elytra conjointly rather feebly arcuate at base, alternate insterstices slightly elevated; with regular rows of large punctures but appearing much smaller through clothing; posthumeral prominence feeble. Abdomen gently convex, except that intercoxal process is slightly depressed; intercoxal process of mesosternum moderately wide, projecting obliquely forwards, with its tip obtuse and feebly bifid; intercoxal process of prosternum about half the width of coxae. Femora stout, tibiae rather strongly bisinuate on lower surface. Length, 3·75 mm.

Hab. Victoria; Mount Feathertop, 6,000 feet, in August (F. E. Wilson from C. Barrett). Type (unique), I. 15946.

The intercoxal process of the mesosternum being bifid (although very feebly so) associates the species with *M. incisus*, from which it differs in being smaller, prothorax with granules much less conspicuous, elytra less uneven, and tibiae more strongly bisinuate. The femora are obscurely ringed; on the abdomen the clothing consists almost entirely of scales, concealing dense and small punctures, except the curved basal row of large ones.

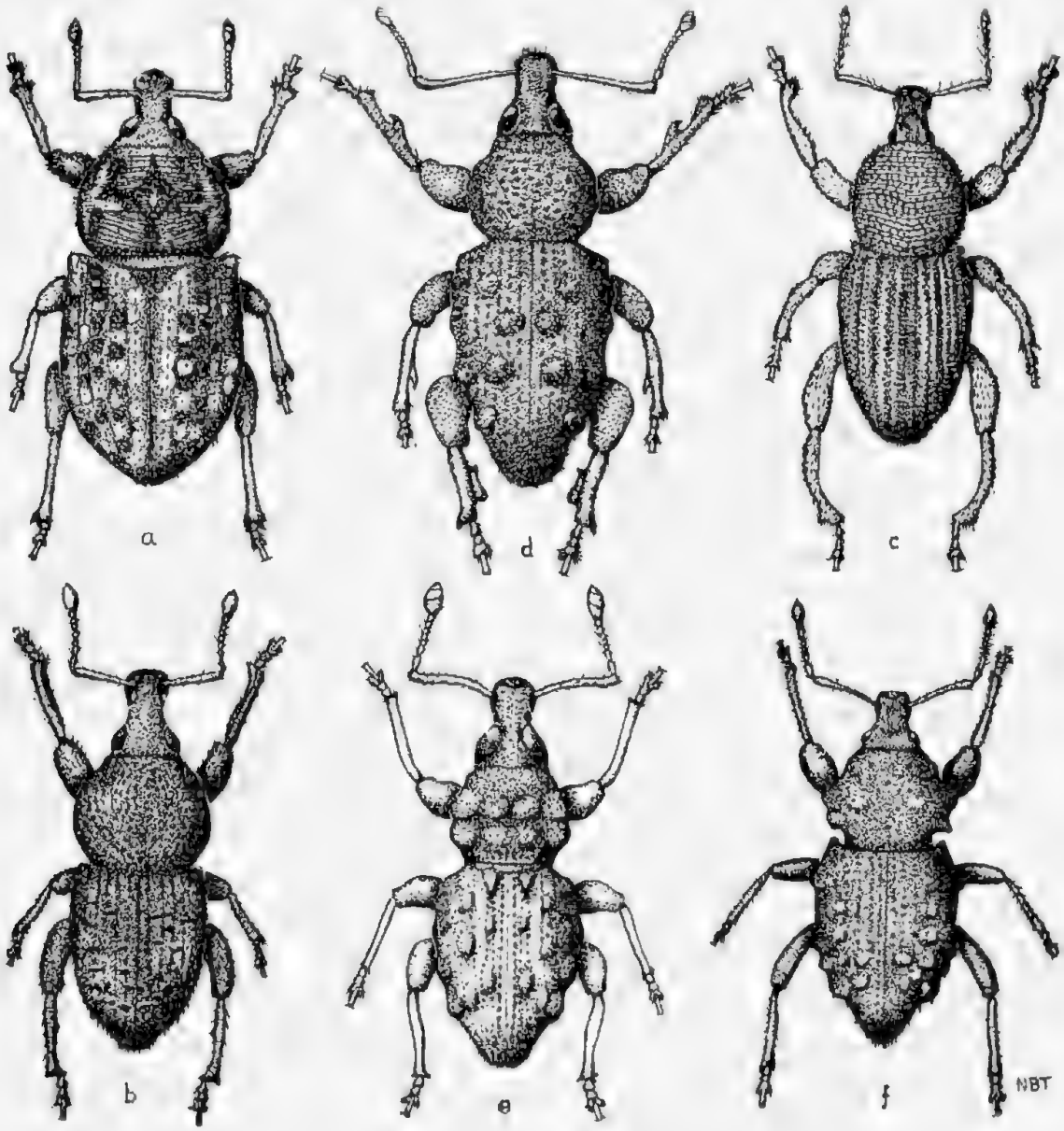

Fig. 79.—a, *Mandalotus crawfordii* Blackburn; b, *M. crudus* Erichs.; c, *M. purifer* Lea; d, *M. insignipes* Lea; e, *M. vigilans* Lea; f, *M. bilobicollis* Lea.

MANDALOTUS PYRIFER sp. nov.

Figs. 78, e; 79, e; 80, p.

♂ Black, antennae and parts of legs obscurely reddish. Densely clothed with muddy-brown scales, and with stout depressed setae, on the elytra dense on the suture and odd interstices, rather sparse on the even ones; legs with thinner and less depressed setae, altering to thin hairs on the under surface of tibiae.

Rostrum stout and curved, median carina concealed. Antennae rather thin. Prothorax almost as long as wide, sides strongly and evenly rounded; granules conspicuously transversely arranged. Elytra conjointly arcuate at base, shoulders prominent, a notch behind each, alternate interstices slightly elevated; punctures normally concealed, except on sides, where they appear very small. Metasternum and two basal segments of abdomen with a wide shallow depression, on which the setae are thinner and more numerous than on the rest of the surface. Mesosternum with a large projecting process, stout at the base, almost acutely conical in front. Front coxae widely separated; femora stout; front tibiae with several acute teeth on the lower surface, the tip acutely produced. Length, 6·5 mm.

Hab. New South Wales: Jindabyne (H. J. Carter).

In the table associated with *M. mesosternalis*, from which it is at once distinguished by the front tibiae, it is also a somewhat larger species, with the mesosternal process more thickened towards base (pear-shaped with the stalk end in front). The clothing of the under surface is somewhat paler than that of the upper surface, and on the depressed parts the setae are thinner than elsewhere; the femora are feebly ringed. There are numerous small dark spots on the elytra. The teeth on the front tibiae are very conspicuous from several directions; on the hind tibiae there are a few inconspicuous ones near the inner apex. No part of the type has been abraded, but the transverse arrangement of the prothoracic granules is so conspicuous that the surface appears to be crossed by numerous thin lines; on the elytra the only punctures indicated are some of the lateral ones, but they are no doubt of large size, both there and elsewhere.

MANDALOTUS AUCHMERESTHES sp. nov.

Fig. 78, d.

♂ Black, tarsi obscurely reddish. Densely clothed with muddy-brown, obscurely variegated scales, interspersed with stout setae; tibiae sparsely ciliated.

Rostrum short, strongly curved, median carina normally concealed. Antennae comparatively thin. Prothorax almost as long as wide, sides strongly rounded, median line distinct; with rather large, round, feebly elevated granules, fairly distinct before abrasion only on the sides. Elytra conjointly arcuate at base,

shoulders prominent, a notch behind each, behind which the posthumeral tubercle is rather conspicuous; alternate interstices feebly elevated and with slight swellings, scarcely tubercles, about summit of apical slope; with rows of large punctures, appearing much smaller through clothing. Metasternum and basal segment of abdomen with a wide, but not very deep depression. Intercoxal process of mesosternum prominent, obliquely dilated from base to near middle, and then obliquely narrowed to apex, which is rather acute. Front coxae rather widely separated, tibiae spurred at apex. Length, 4·5–5·5 mm.

♀ Differs in being somewhat wider, abdomen and metasternum without a depression, intercoxal process of mesosternum much shorter, the apex very obtusely produced, legs shorter and stouter, front coxae slightly more apart, and tibiae less curved towards apex, with their under surface setose.

Hab. New South Wales: Eccleston, abundant (J. Hopson). Type, I. 15947.

The apical half of the elytra is not irregular owing to tubercles, although some of the interstices are somewhat thickened, so the species in the 1914 table of the genus could be associated with *M. variabilis* and *M. vacillans*; from the former it differs in its clothing and in the tip of the front tibiae (arched inwards at the apex, instead of dilated both inwards and outwards there); from the latter by the very different shape of the mesosternal process. On an occasional specimen the legs are obscurely reddish, but they are usually deep black; the antennae are almost black. On the pronotum the granules, even on the sides, are normally inconspicuous before abrasion. The elytral punctures are large, close together, and decidedly wider than the interstices, but before abrasion they appear to be not very close together, and less than half the width of the latter; they are larger and less rounded on the male than on the female.

MANDALOTUS PENTAGONALIS sp. nov.

Fig. 80, cc.

♂ Dark brown, under surface and legs pale castaneous, antennae darker. Densely clothed with dark brown scales, becoming greyish on the sides and legs; in addition with numerous short setae; under surface with scales and setae on the sides, but with setae only elsewhere.

Rostrum short and curved; median carina concealed. Antennae comparatively thin. Prothorax moderately transverse, sides rounded and widest at apical third, median line obsolete, granules crowded and fairly distinct through clothing. Elytra conjointly arcuate at base, shoulders rounded, posthumeral prominence very feeble, alternate insterstices feebly elevated; punctures appearing rather small through clothing. Abdomen with crowded, and rather small, asperate

punctures, quite distinct through the sparse clothing; basal segment and metasternum with a shallow, wide depression. Intercoxal process slightly projecting, sides obliquely dilated from base to beyond the middle, and then narrowed to apex. Front coxae slightly but distinctly separated; all tibiae spurred at apex. Length, 5 mm.

Hab. Victoria: Cheltenham, from moss in April (F. E. Wilson). Type (unique), I. 15948.

The mesosternal process is shaped much as in the preceding species, but is smaller, and the front coxae are closer together; the two species differ also in the abdomen, and the present species has the prothoracic granules fairly distinct before abrasion, even in the middle. The type is probably immature, but several species are normally quite as pale. It has not been abraded to make sure of the size of the elytral punctures, but they are probably large; before abrasion they appear to be much narrower than the interstices.

MANDALOTUS SETISTRIATUS sp. nov.

Fig. 80, k.

♂ Black, antennae and tarsi reddish. Densely clothed with muddy-brown scales, interspersed with stiff, sloping setae.

Rostrum short, moderately curved; median carina clothed but normally traceable. Antennae moderately thin. Prothorax slightly transverse, sides strongly and evenly rounded; granules small, and normally traceable before abrasion only on the sides. Elytra conjointly rather deeply arcuate at base, posthumeral tubercle not traceable, interstices even; punctures of large size, but appearing much smaller through clothing. Basal segment of abdomen with two small and rather acute tubercles, slightly closer to sides than to each other. Front coxae almost as widely separated as middle ones; hind tibiae with a small acute tooth one-third from apex. Length, 3·5 mm.

Hab. New South Wales: Hastings River (T. G. Sloane). Type (unique), I. 15954.

Very distinct by the abdomen and hind tibiae. The elytra, when viewed from behind, appear to have the setae in quite regular rows; after abrasion their punctures are seen to be distinctly wider than the interstices.

MANDALOTUS TENUIS sp. nov.

Fig. 78, e.

♂ Blackish, antennae and legs obscurely reddish. Moderately clothed with ashen grey scales, interspersed with setae; most of under surface polished and glabrous.

Head with base bald and shining. Eyes much smaller than usual in genus. Rostrum not very long, rather suddenly dilated about apex; median carina inconspicuous. Antennae moderately long. Prothorax distinctly longer than wide, median line well defined; granules small, numerous, and rather rough. Elytra elongate, base feebly conjointly arcuate, shoulders rounded, posthumeral prominence almost absent; alternate interstices feebly elevated; with regular rows of large punctures. Abdomen with well-defined punctures, more crowded on apical segment than elsewhere, second segment with two small, acute tubercles, close together near the tip. Intercoxal process of mesosternum about the width of coxae. Front coxae almost touching; tibiae strongly incurved on one side between middle and apex. Length, 2·25 mm.

Hab. Victoria: Beaconsfield, in March, April, and July (F. E. Wilson). Type, I. 15953.

In the table associated with *M. ampliceollis*, from which it differs widely; from the preceding species it differs in the distance between the front coxae, in the hind tibiae, and in the distance separating the abdominal tubercles, these are very conspicuous from the sides. The ocular lobes and the incurvature at apex of prosternum are unusually feeble. The bald part of the head commences immediately behind the eyes, these being much smaller than usual. The elytral clothing is rather sparse, as a result of which the full size of most of the punctures is visible before abrasion. The hind tibiae from several points of view appear to have the inner apical half scooped out, much as on the male of *M. cellaris*. On the type the under surface is entirely black, on the second it is black, except for the apex of abdomen, on the third it is entirely bright castaneous; the last specimen was taken from a nest of the ant *Eclatomma metallicum*, but it was probably there by accident.

MANDALOTUS BIMACULATUS sp. nov.

♂ Black, antennae and tarsi obscurely paler. Densely clothed with sooty-brown scales, becoming paler on parts of under surface and legs, elytra with two whitish spots at base; with fairly dense, stout, curved setae, but confined to a single row on each elytral interstice.

Rostrum somewhat longer and less curved than usual, median carina concealed almost throughout. Antennae comparatively thin. Prothorax slightly wider than long, sides strongly rounded; granules conspicuously transversely arranged. Elytra conjointly arcuate at base, the width there slightly less than middle of prothorax, posthumeral tubercle distinct; interstices evenly convex; punctures conspicuous before abrasion, but appearing much smaller than they really are. Basal segment of abdomen scarcely depressed, an elongated tubercle

at middle of apex. Front and middle coxae almost equally widely separated; lower surface of hind tibiae with a tooth near apex and one at apex itself. Length, 6 mm.

Hab. Queensland: Mount Tambourine (C. J. Wild). Type (unique), in Queensland Museum.

An ordinary looking species, but very distinct by the prothoracic granules and abdominal carina. The front and middle tibiae have small teeth, but these are scarcely traceable through the clothing.

MANDALOTUS BIVITTICOLLIS sp. nov.

♂ Black, antennae and tarsi obscurely reddish. Densely clothed with sooty-brown and greyish-white scales, irregularly distributed, and with moderately stout, curved setae.

Rostrum moderately stout and curved; median carina concealed. Antennae rather long and thin. Prothorax slightly transverse, sides strongly rounded, median line feeble; granules feeble, and normally quite concealed. Elytra conjointly arcuate at base, posthumeral prominence absent; third interstice with a feeble elongated tubercle just beyond the middle, fifth with a still more feeble one nearer the apex, and remnants of others between it and the base; with almost regular rows of punctures, appearing rather small through clothing, but probably of rather large size. Basal segment of abdomen with a small acute tubercle in middle of apex. Front and middle coxae widely separated; tibiae longer and thinner than usual. Length, 3 mm.

Hab. Victoria: Melbourne (W. du Boulay). Type (unique), I. 15959.

In the table associated with *M. tuberculiventris*, from which it differs in being smaller and much narrower, and the abdominal tubercle practically at the apex of the basal segment instead of some distance before it; the tubercle is quite conspicuous from the sides. The scales on the pronotum are mostly sooty, but there is a conspicuous whitish vitta on each side; on the elytra they are mostly pale, but become sooty on the tubercular swellings; on most parts of the under surface the scales are rather sparse, so that the finer sculpture is not obscured.

MANDALOTUS ARMIVARIUS sp. nov.

Figs. 78, f; 80, q.

♂ Blackish-brown, antennae and legs obscurely reddish. Densely clothed with muddy-brown scales, interspersed with subcreet setae; the under surface more sparsely clothed. Rostrum short and curved; median carina shining; and distinct from base to apical plate. Antennae rather thin. Prothorax almost as

wide as long, sides strongly and evenly rounded, median line partly obscured; granules inconspicuous before abrasion. Elytra conjointly arcuate at base, posthumeral prominence practically absent; alternate interstices very feebly elevated; punctures appearing small through clothing, when not concealed. Basal segment of abdomen and metasternum rather deeply concave, the cavity on the abdomen bounded on each side by an obtuse carina, which terminates practically at the apex of the segment in a distinct tooth. Front coxae almost as widely separated as the middle ones, front tibiae subdentate near base, the hind ones acutely dentate about middle. Length, 3–3·5 mm.

♀ Differs in being somewhat wider, abdomen and metasternum not concave, the former without carinae, femora thinner, and front and hind tibiae simple.

Hab. Victoria: Belgrave in July and November, Ferntree Gully in April (F. E. Wilson). Type, I. 15952.

Regarding the abdomen as bituberculate, in the 1914 table of the genus, as well as in the accompanying one, the species would be associated with *M. taylori*, from which it differs in being much smaller, and with the abdominal depression continued on to the metasternum, instead of confined to the apical half of the segment; the legs also differ in many respects. Regarding the abdomen as bicarinate, it should be placed with *M. excavatus*, which has very different legs, and prothoracic granules transversely arranged. On abrasion the prothoracic granules are seen to be small, even on the sides, and the elytral punctures large and wider than the interstices. On the male the front tibiae are acutely spurred at apex; near the apex on the under side a narrow flange commences, which gradually dilates till it abruptly ends near the base, almost at a right angle. The femora of the male are somewhat roughened about the middle, but could scarcely be regarded as dentate. The antennae and legs are conspicuously red on some specimens, and on such the abdomen and other parts of the under surface are also reddish, but fully matured specimens have most of the body parts black, or almost so.

MANDALOTUS INSIGNIPES sp. nov.

Figs. 78, g; 79, d.

♂ Dark brown, antennae obscurely reddish, legs and parts of under surface somewhat castaneous. Densely clothed with brownish scales, sparsely interspersed with setae.

Rostrum short, stout, and curved; median carina concealed. Antennae rather long and thin. Prothorax moderately transverse, sides unevenly rounded; granules feebly defined before abrasion. Elytra feebly trisinuate at base, shoulders rounded, suture considerably thickened on apical slope; third interstice

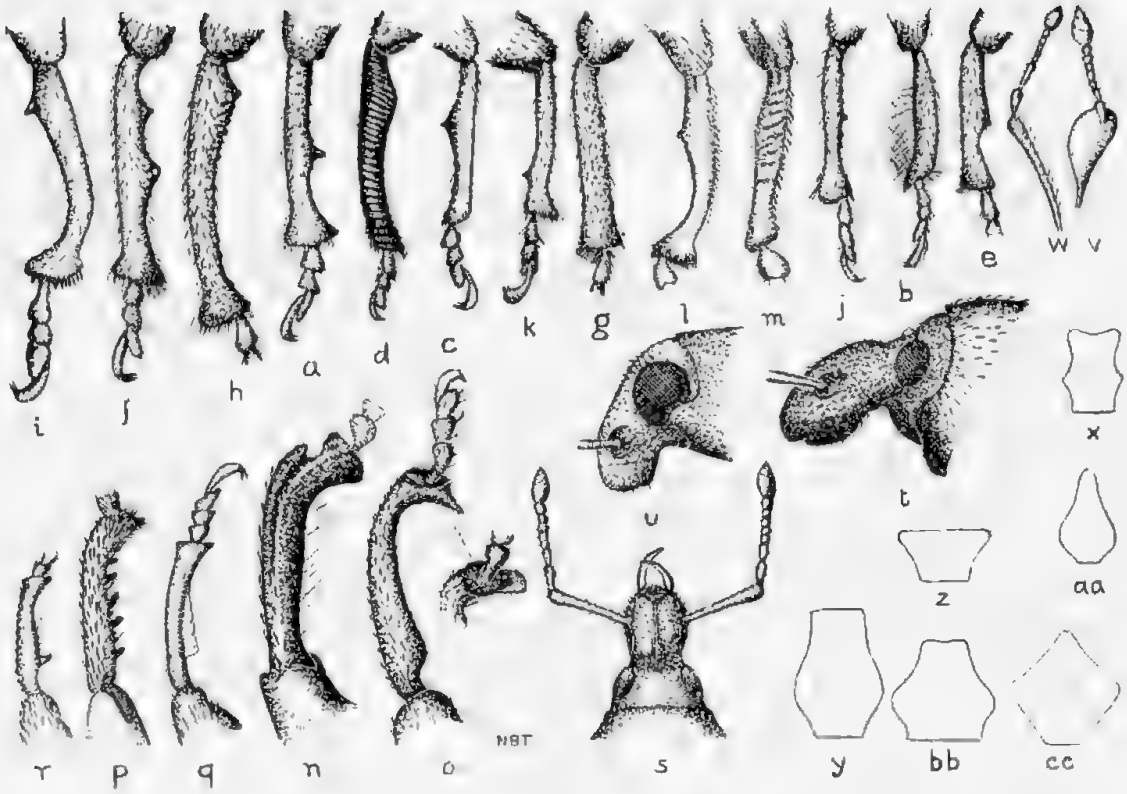

Fig. 80. a, Part of hind leg of *Mandalotus punctiventris* Blackb.; b, of *M. insulatus* Lea (tarsus five-jointed); c, of *M. advenus* Blackb.; d, of *M. carinatipes* Lea; e, of *M. ciliaris* Pasc.; f, of *M. fergusoni* Lea; g, of *M. granulatus* Lea; h, of *M. rudis* Lea; i, of *M. scaber* Lea; j, of *M. sydneyensis* Lea; k, of *M. setistriatus* Lea; l, m, of *M. medioxalis* Lea. n, Part of front leg of *M. dentipes* Lea; o, of *M. laminatipes* Lea; p, of *M. pyciter* Lea; q, of *M. armivarius* Lea; r, of *M. hoplocnemus* Lea. s, Head of *M. blackmorei* with deciduous mandibular processes; t, of *M. intercularis* Lea, showing intercular granule; u, of *M. macrops* Lea. v, Antenna of *M. pondericornis* Lea; w, of *M. tenuicornis* Lea. x, Prosternal process of *M. armipectus* Lea. y, mesosternal process of *M. intercoxalis* Lea; z, of *M. laminipectus* Lea; aa, of *M. mesosternalis* Lea; bb, of *M. uniformis* Lea; cc, of *M. pentagonalis* Lea.

with three tubercles, including one at base, fifth and seventh each with three, and a few smaller ones elsewhere; with large, partially concealed punctures. Abdomen with a deep depression on basal two-thirds of first segment, and continued on to metasternum. Front coxae practically touching; femora very stout; front and middle tibiae deeply notched, hind ones with two very large teeth, of which one is much larger than the other. Length, 3·5 mm.

♀. Differs in being wider, eyes smaller, prothorax less transverse, most of the elytral tubercles of smaller size, the apical slope with paler clothing, abdomen convex and simple, femora thinner and tibiae simple.

Hab. Victoria: Millgrove in January (F. E. Wilson). Type, I. 15950.

Its legs render this species probably the most remarkable one of the genus. The basal segment of the abdomen of the male has a deep depression, with the sides of the intercoxal process ridged; behind the depression there is a feeble

carina, interrupted in the middle, hence its position in the table. But regarding the abdomen as neither carinate nor tuberculate, and referring the species to DDD, it is distinct from all the species placed there by its remarkable tibiae. In the 1914 table it could be associated with *M. excavatus*, which has the prothoracic granules transversely arranged and ordinary legs. The eyes of the male are so large that each is fully as wide as the distance between them, although this is scarcely evident from above. The elytral tubercles are so placed as to appear in rows from almost any direction, much as trees in an orchard. The female has the under parts and legs darker than in the male, the latter probably not being fully matured when taken.

MANDALOTUS DENTICULATUS sp. nov.

♂ Blackish-brown, parts of antennae and of under surface obscurely reddish, legs paler. Moderately clothed with brownish scales, interspersed with fairly long setae; under surface sparsely clothed; tibiae ciliated on under surface.

Rostrum short and strongly curved; median carina not traceable. Antennae moderately long. Prothorax moderately transverse, sides and disc uneven, owing to large, partially concealed granules. Elytra slightly arcuate at base, with numerous more or less distinct tubercles; punctures large but appearing much smaller through clothing. Metasternum and basal segment of abdomen conjointly moderately concave, the depression on the abdomen bounded posteriorly by a curved and rather feeble carina, the middle of which touches the apex of the segment. Middle coxae rather widely separated, the front ones touching; femora stouter than usual; front and middle tibiae denticulate from near base, hind ones with a small acute tooth at basal third, and thence denticulate to apex. Length, 3–3·5 mm.

♀ Differs in having the elytral tubercles more unevenly placed, the arcuation of the base somewhat interrupted by the base of the third interstice on each, basal segment of abdomen gently convex and noncarinated, femora thinner, and tibiae simple.

Hab. Victoria: Millgrove in January, Belgrave in October and December, and Beaconsfield in August (F. E. Wilson). Type, I. 15957.

In the 1914 table of the genus this species could be associated with *M. bryophagus*, but the abdomen and its carina are different, and the elytra are conspicuously tuberculate. The carina, instead of being evenly elevated, is depressed in the middle, owing to the general concavity of the segment it is on. Small females (one of which was taken from under fallen leaves) somewhat resemble the type (a female) of *M. rufipes*, but on that species the front coxae are not in contact. On the male (only one of which was taken) the largest

tubercle is on the third interstice, just beyond the middle; it is the inner one of an oblique row of four; beyond this row is a second, of which the largest tubercle is on the fifth interstice, and there is a less conspicuous row near the apex; towards the base there are several smaller inequalities of the surface, and the suture also is thickened at the summit of the apical slope.

MANDALOTUS BREVICARINATUS sp. nov.

Fig. 78, h.

♂ Black, antennae and parts of the legs obscurely reddish. Densely clothed with muddy-brown scales feebly variegated with paler ones, and interspersed with numerous sloping setae.

Rostrum short and curved; median carina concealed almost throughout. Antennae moderately thin. Prothorax slightly longer than wide, sides strongly rounded; granules fairly large, close together, and distinct before abrasion. Elytra conjointly but not quite evenly arcuate at base, posthumeral prominence scarcely traceable, alternate interstices feebly elevated; punctures large and wider than interstices, but appearing very small through clothing, or even concealed. Basal segment of abdomen with a short, curved carina, not quite one-third of the width of the segment, its middle touching the tip, between it and the base the surface is depressed, somewhat shining, and with crowded punctures. Front coxae touching; front and middle tibiae feebly denticulate, the apex spurred; hind tibiae neither denticulate nor spurred. Length, 4–4·5 mm.

Hab. Tasmania; Launceston (Aug. Simson). Type, I. 15958.

In the 1914 table of the genus this species could be associated with *M. bryophagus*, but the three males before me are all larger than the type of that species, the abdomen is more concave at its base, and the distance between the middle coxae is distinctly greater. There is a slight transverse arrangement of the prothoracic granules on the sides, but it is not continuous across the middle. The funicle and tarsi are paler than the rest of the appendages, at first glance the scape and club appearing to be almost black.

MANDALOTUS RECTICARINATUS sp. nov.

♂ Black, funicle, tarsi, and trochanters reddish. Densely clothed with muddy-brown, feebly variegated scales, interspersed with stout setae.

Rostrum short, stout, and curved; median carina not traceable. Antennae not very long. Prothorax moderately transverse, sides strongly rounded, median line distinct; granules numerous and fairly well defined, even before abrasion. Elytra conjointly arcuate at base, basal half parallel-sided, posthumeral prominence absent, alternate interstices feebly elevated; with rows of large, but

normally almost, or quite, concealed punctures. Basal segment of abdomen moderately convex, a short, straight carina fairly close to its apex. Front coxae widely separated; femora stout; tibiae spurred. Length, 2·25–2·5 mm.

♀ Differs in having the prothorax smaller, with its sides more evenly rounded, elytra wider and less evenly arcuate at base, abdomen more convex and without a carina, and legs shorter and somewhat thinner.

Hab. South Australia; Myponga, numerous specimens from moss (A. H. Elston). Type, I. 12870.

A small species, very distinct by the abdominal carina of the male, this being transverse, quite straight, and not much longer than the intercoxal process of the mesosternum; the species is smaller even than *M. minutus*, which has the carina arched and touching the apex of the segment. The scape and club are conspicuously darker than the funicle; on an occasional specimen the legs are almost entirely reddish, and on such the under parts are also more or less obscurely reddish. On the elytra the setae are confined to a single row on each alternate interstice. On fresh specimens there are distinct pale markings on the sides of the prothorax, and on the apical half of the elytra. On abrasion the elytral punctures of the male are seen to be almost as wide as the interstices, on the female they are somewhat smaller.

MANDALOTUS HYSTRICOSUS sp. nov.

Fig. 78, i.

♂ Black, antennae and parts of legs more or less reddish. Densely clothed with scales varying from ochreous, through brown, to black, and thickly interspersed with stiff subercct setae; under surface of tibiae ciliated.

Rostrum stout and strongly curved; median carina thin and traceable through clothing. Antennae rather long and thin. Prothorax distinctly transverse, sides gently increasing in width from near base to beyond the middle; with rather large, flattened granules, fairly distinct before abrasion. Elytra trisinuate at base, shoulders prominent, posthumeral prominence large but obtuse; with small tubercles scattered about, and two fairly large ones on the third interstice, at base and beyond the middle; punctures appearing rather small through clothing. Basal segment of abdomen with a wide curved carina, its middle touching apex of segment, owing to the sudden incurvature of the latter, between it and base depressed, shining, and with numerous small punctures. Front coxae widely separated; front tibiae with apical two-thirds of lower surface strongly arched and finely denticulate, middle tibiae less strongly arched and denticulate, hind tibiae with an inner subapical tooth, in addition to the apical spur. Length, 6 mm.

Hab. Tasmania: Corinna (Aug. Simson). Type (unique), I. 15955.

In the 1914 table of the genus this species could be associated with *M. longicollis* and *M. arciferus*, from both of which it is distinguished by the hind tibiae, on which there is a distinct tooth near the inner apex; on *longicollis* the apex itself curves round, so as to present the appearance of a semi-double tooth; on *arciferus*, except for the apical spur, the tibiae are simple. The type has not been abraded, as it is in perfect condition; probably on older specimens the clothing would be of the usual muddy-brown. Seen from behind the elytra appear rather strongly trisinuate at base; from directly above the trisinuation is much less pronounced, although quite evident.

MANDALOTUS VIGILANS sp. nov.

Fig. 79, e.

♂ Dark brown, antennae and legs paler, sometimes almost flavous. Moderately clothed with brownish or brownish-grey scales, sparsely interspersed with setae; under surface and legs more sparsely clothed.

Eyes very large and round. Rostrum short and curved; median carina apparently absent. Antennae rather long and thin. Prothorax distinctly transverse; with six obtuse tubercles, of which two on each side cause it to appear bilobed; with a few granules scattered about. Elytra feebly trilobed at base, shoulders rounded off; third interstice with three tubercles, a fairly large one at base, one about as large just beyond the middle, and a small one between them; fifth also with three tubercles placed slightly posterior to those on the third, seventh and ninth with several feeble tubercles; with rows of rather large punctures, partially obscured by clothing and interrupted by tubercles. Basal segment of abdomen with coarse punctures, and a comparatively narrow median impression. Front coxae apparently touching, middle ones not widely separated; femora very stout; tibiae thin. Length, 2·5–3 mm.

♀ Differs in being considerably wider, eyes smaller, prothorax more transverse, elytral tubercles of altered sizes, basal segment of abdomen larger, more convex, without large punctures or a median depression, and femora thinner.

Hab. Victoria: Millgrove in January, Belgrave in January and July, from fallen leaves (F. E. Wilson). Type, I. 15964.

A small species, with conspicuous elytral tubercles, and unusually large eyes; in the male the distance separating these at their nearest point is less than half the diameter of an eye, in the female the distance is slightly more than the diameter of an eye. In the table it is associated with *M. bilobicollis* (from Lord Howe Island), which has very different shoulders. On fresh specimens, in certain lights, some of the scales have a golden gloss.

MANDALOTUS HYPULUS sp. nov.

♂ Black, antennae and parts of legs somewhat reddish. Densely clothed with sooty-brown, feebly variegated scales; each femur with a pale ring; with short setae, rather sparsely scattered about; tibiae rather feebly ciliate.

Rostrum, short, stout, and curved; median carina faintly indicated through clothing. Antennae rather long and thin. Prothorax slightly wider than long, sides feebly dilated from near base to beyond the middle; with crowded and small granules, distinct on abrasion, but feebly indicated normally. Elytra trisinuate at base, notched behind each shoulder, posthumeral prominence scarcely indicated; alternate interstices feebly elevated, the third with a swelling at base, and a fairly distinct tubercle at summit of apical slope, the fifth with two, one just before and one below summit of apical slope; with rows of large punctures, wider than the interstices, but appearing much smaller through clothing, and many quite concealed. Abdomen with a wide and fairly deep depression on basal segment, continued on to second, but shallower there. Front coxae practically touching, tibiae feebly denticulate. Length, 5 mm.

Hab. Tasmania (Aug. Simson). Type (unique), I. 15963.

In addition to the distinct tubercles about the summit of the apical slope, there are other faintly indicated ones posteriorly. The clothing would probably be more variegated on fresher specimens than on the type, as the pale scales on the femora and some of those elsewhere have a slight golden gloss.

MANDALOTUS FUNEREUS sp. nov.

♂ Black, claw joints reddish. Densely clothed with sooty-brown, feebly variegated scales, interspersed with stout, depressed setae.

Eyes small. Rostrum stout and strongly curved; median carina invisible. Antennae fairly long and thin. Prothorax slightly transverse, sides strongly and evenly rounded; granules placed transversely. Elytra deeply conjointly arcuate at base, slightly notched behind each shoulder, with the posthumeral prominence fairly distinct; third and fifth interstices subtuberculate at and about summit of apical slope, the third also at base; with large punctures, much wider than the interstices, but appearing quite small through the clothing, and a few entirely concealed. Basal segment of abdomen very feebly depressed in middle. Front coxae widely separated, front and hind tibiae rather feebly denticulate on lower surface, the middle pair still more feebly. Length, 7 mm.

Hab. Victoria: Alps (T. G. Sloane). Type (unique), I. 15965.

A large species, but with tubercles so feeble that it was only after hesitation it was placed in F in the table; regarding the elytra as nontuberculate, it could be associated with *M. transversus*, a wider species, with base of elytra different,

The scales, and the setae placed amongst them, vary from an obscure brown to black, and are entirely without gloss (the type is apparently in perfect condition); on the elytra the stout setae are denser on the suture and on the swellings than elsewhere. On abrasion the prothorax is seen to be traversed by numerous thin, interrupted carinae, rather than granules transversely arranged

MANDALOTUS MEDCOXALIS sp. nov.

Figs. 78, j; 80, l, m.

♂ Black, antennae and legs more or less reddish. Densely clothed with scales varying from greyish to sooty-brown, and interspersed with numerous sloping setae; front tibiae conspicuously ciliated.

Rostrum rather short, middle carina thin and distinct throughout. Antennae moderately long and thin. Prothorax slightly transverse, sides strongly rounded; surface traversed by numerous short, interrupted carinae, or by granules transversely arranged, and traceable before abrasion. Elytra conjointly, rather deeply arcuate at base, but arcuation interrupted on each side by a swelling at the base of the third interstice; a notch behind each shoulder, posthumeral prominence rather conspicuous; with subtubercular swellings on and about summit of apical slope; punctures large and wider than interstices, but appearing much smaller through clothing. Basal segment of abdomen and metasternum jointly shallowly depressed. Front coxae widely separated; middle coxae armed with a thin, blunt tooth, projecting obliquely backwards; front tibiae strongly curved, hind ones with an oblique ridge on lower surface, and between there to apex strongly incurved. Length, 5–6 mm.

Hab. New South Wales. Dorrigo (W. Heron and H. J. Carter). Type, I. 15960.

Readily distinguishable by the characters noted in the table. The elytra have a rough appearance, but, except about the base, they could hardly be regarded as tuberculate; regarding them as such, however, in the table the species could be distinguished from all those referred to F by the armed middle coxae. The ridge on the hind tibiae from the sides appears as a small tooth. Of the three males obtained only one has apparently attained its full colouring, the others have the antennae and legs rather pale, with most of the under surface also somewhat reddish.

MANDALOTUS OXYOMUS sp. nov.

♂ Black, antennae and tarsi obscurely reddish. Densely clothed with muddy-brown scales, obscurely variegated with small paler and darker spots;

with numerous setae, mostly decumbent; tibiae with rather thin setae on under surface, but not ciliated.

Eyes comparatively small and quite circular. Rostrum short and strongly curved; median carina not traceable. Antennae moderately long and thin. Prothorax rather feebly transverse, sides strongly and evenly rounded; traversed by numerous short, flattened ridges, or transversely placed granules. Elytra conjointly arcuate at base, shoulders laterally prominent, a distinct notch between each, and a conspicuous posthumeral tubercle; alternate interstices feebly elevated; with large punctures, appearing small through clothing, or even concealed. Basal segment of abdomen shallowly depressed about base, the depression continued on to metasternum. Middle coxae with a conspicuous ridge or obtuse tooth; front coxae widely separated; front and middle tibiae feebly denticulate, the hind pair with apical half strongly arched, and blunt tipped. Length, 5 mm.

Hab. South Australia: Mount Lofty (A. H. Elston). Type (unique), I. 15977.

The middle coxae could scarcely be regarded as armed, still the ridge is very conspicuous from the sides, and from some directions appears almost as a tooth, and to a certain extent approaches that of *M. dentipes;* from that species it is at once distinguished by the front tibiae, the apex of which, on *dentipes*, is conspicuously notched.

MANDALOTUS MULTICARINATUS sp. nov.

♂ Black, antennae and parts of legs obscurely reddish. Moderately clothed with muddy-brown scales, with rather sparsely interspersed setae; under surface with thin setae only.

Rostrum rather short and curved; median carina not traceable. Antennae fairly long and thin. Prothorax moderately transverse, sides strongly and almost evenly rounded; disc traversed by numerous thin carinae, in places broken up into transverse granules, and distinct before abrasion. Elytra conjointly arcuate at base; interstices not separately convex, and not alternately elevated; punctures comparatively small. Under surface with crowded and small punctures; basal segment of abdomen with a shallow depression, continued on to metasternum. Front coxae moderately separated, all tibiae suddenly dilated at apex. Length, 3 mm.

Hab. Victoria: Kulkyne in September (F. E. Wilson). Type (unique), I. 15966.

The sparse and thin clothing of the under surface allows the derm to be seen, as in *M. crawfordi*, with which it could be associated in the 1914 table of

the genus, but from which it differs in having the body parts black, with the antennae and parts of legs obscurely reddish, instead of almost flavous; in *crawfordi*, except for some of the scales, only the eyes are black; that species also has rather dense elytral setae. The elytral punctures are decidedly smaller than is usual in the genus, on abrasion their greatest width is seen to be less than one-third the width of the interstices; on the males of *crawfordi*, after abrasion, they are seen to be fully half the width of the interstices. There is a slight notch behind each shoulder, rendering it laterally prominent.

MANDALOTUS STRIATUS sp. nov.

♂ Black, antennae and parts of legs dull reddish. Densely clothed with muddy-brown scales, interspersed with subercct setae.

Eyes smaller and more convex than usual. Rostrum short and curved; median carina not traceable. Prothorax not much wider than long, sides feebly increasing in width from base to apex, and then suddenly narrowed; disc traversed by numerous flattened ridges, or transversely placed granules, traceable before abrasion. Elytra elongate-cordate, base conjointly arcuate, shoulders rounded off, without posthumeral prominences, interstices not alternately elevated; with rows of comparatively small punctures, quite concealed before abrasion. Basal segment of abdomen feebly depressed in middle. Front coxae moderately separated; tibiae with apical spur. Length, 2·5 mm.

Hab. South Australia: Leigh Creek (Rev. T. Blackburn). Type (unique), I. 15967.

Structurally fairly close to *M. subhumeralis*, but without the posthumeral tubercle of that species, and with thinner legs; in the 1914 table of the genus both could be associated with *M. arcuatus*, which has a larger and more rounded prothorax and comparatively large elytral punctures. Before abrasion the elytra appear to be finely striated and without punctures; even after abrasion the punctures in the striae are seen to be decidedly narrower than the interstices, and these to be densely and minutely punctate. The elytral setae are confined to a single row on each interstice.

MANDALOTUS LATEBRICOLA sp. nov.

♂ Black, antennae and legs partly reddish. Densely clothed with muddy-brown or muddy-grey, slightly variegated scales, interspersed with stout setae, on the elytra mostly confined to the alternate interstices.

Rostrum short and strongly curved. Antennae moderately thin. Prothorax moderately transverse, sides strongly rounded; granules transversely arranged or conjoined to form numerous short ridges or carinae. Elytra conjointly but

rather feebly arcuate at base, shoulders rounded, posthumeral prominence fairly distinct, sides subparallel to beyond the middle, alternate interstices feebly elevated; with rows of large punctures, appearing very small through clothing, and some of them quite concealed. Basal segment of abdomen slightly depressed in middle. Front coxae moderately separated; tibiae acutely spurred at apex. Length, 2·5–3 mm.

♀ Differs in being slightly wider, abdomen more convex, and legs and antennae somewhat shorter.

Hab. Victoria: Ringwood in June, July, and September, Ferntree Gully in April and September, Eltham in September, and Healesville in August (F. E. Wilson). Type, I. 15968.

In the 1914 table this species could be associated with *M. abdominalis* and *M. arcuatus;* in size and general appearance it is much like the former, but the abdomen is evenly clothed in both sexes; from the latter it differs in being wider, elytra different at base, alternate interstices somewhat elevated, and in the tips of the tibiae. In general appearance it is strikingly close to *M. trisinuatus*, but the hind tibiae are not subdentate near base. On specimens in good condition the transverse arrangement of the prothoracic sculpture is quite evident, and after abrasion is seen to consist of numerous fine ridges and conjoined granules, but a small amount of dirt obscures it. On several specimens the funicle and tarsi are conspicuously paler than the adjacent parts. Most of the specimens were taken from tussocks or mosses.

MANDALOTUS PUNCTICOLLIS sp. nov.

♂ Blackish; antennae, legs, and parts of under surface more or less reddish. Densely clothed with muddy-brown scales, interspersed with stout setae, on the elytra the setae confined to a single row on each interstice.

Eyes unusually small. Rostrum stout and moderately curved; median carina apparently absent. Antennae rather short. Prothorax moderately transverse; sides subangulate in middle; with dense concealed punctures, and without granules. Elytra cubcordate; conjointly arcuate at base, shoulders rounded off, posthumeral prominence absent, interstices even; with rows of large punctures, normally almost or quite concealed. Abdomen with basal segment gently depressed. Front coxae touching, tibiae spurred at apex. Length, 2–2·5 mm.

♀ Differs in having abdomen gently convex, and with somewhat shorter antennae and legs.

Hab. South Australia: Berri. Type, I. 15975.

In the 1914 table this species could be associated with *M. maculatus* and *M. squamibundus*, from both of which it differs in being considerably smaller;

in addition it is distinct from the former by the absence of elytral spots, and its smaller eyes with coarser facets; from the latter it is also distinct by its narrower form and sparser and finer setae; the eyes are also somewhat smaller. On abrasion the pronotum is seen to be densely punctate and without granules.

MANDALOTUS MACROPS sp. nov.

Fig. 80, u.

♂ Black; antennae and legs somewhat reddish. Densely clothed with muddy-grey scales, becoming paler on apical slope of elytra, and sparse on under surface; a few suberect setae scattered about.

Eyes unusually large and quite round. Rostrum short and slightly curved; median carina distinct in front. Antennae moderately long and thin. Prothorax moderately transverse, sides strongly rounded, median line distinct; with rounded granules, readily traceable through clothing; ocular lobes unusually prominent. Elytra elongate subcordate, conjointly arcuate at base, shoulders oblique, posthumeral prominence very feeble; with rows of distinct punctures, appearing small through clothing, but probably large. Basal segment of abdomen with a longitudinal depression. Front coxae touching, femora stout, tibiae rather thin and rather feebly spurred. Length, 2·25 mm.

Hab. Victoria: Healesville in March (F. E. Wilson). Type (unique), I. 15974.

In the 1914 table this species could be associated with *M. maculatus* and *M. squamibundus*, from which it is distinguished by the larger eyes and more prominent ocular lobes. The eyes are so large that the distance between them at their nearest approach to each other is scarcely half the diameter of an eye. The front of the prosternum is deeply and almost angularly notched, causing the ocular lobes to appear unusually prominent. On the type many of the scales have a slight golden gloss, this becoming quite conspicuous on the apical slope of elytra; it is probable, however, that the gloss is distinct only on fresh specimens. In places the interstices are feebly thickened, causing slight divergences of the adjacent rows of punctures, but they could not fairly be regarded as tuberculate.

MANDALOTUS CORDIPENNIS sp. nov.

Black, parts of antennae and of legs reddish. Densely clothed with muddy-brown scales, variegated with pale spots, and interspersed with numerous stout, semi-erect setae.

Rostrum very short and curved; median carina not traceable. Antennae not very long. Prothorax distinctly transverse, sides strongly rounded; with

rather coarse granules, traceable before abrasion. Elytra cordate, across middle almost twice the width of prothorax, shoulders rounded off, without posthumeral tubercles; alternate interstices very feebly elevated, and slightly uneven about summit of apical slope; with rows of large punctures, appearing very small through clothing. Abdomen moderately convex. Front coxae almost touching, tibiae feebly spurred. Length, 2–2·5 mm.

Hab. Victoria; Lorne in October, Beaconsfield in April (F. E. Wilson). Type, I. 15971.

A small, compact species, with but feeble external indications of sex; the female is slightly larger, wider (more noticeably in middle of elytra than elsewhere), and the abdomen is more convex, although even in the male it is certainly not flat. The incurvature at the apex of the prosternum and the ocular lobes are feeble, and the claws are smaller than usual. On specimens in perfect condition there are numerous spots on the elytra, some of which are almost square, but on most of the specimens taken by Mr. Wilson the variegation is very feeble. On some specimens the legs and antennae are entirely red, but the funicle, coxae, and tarsi are usually of a brighter red than the adjacent parts, although the scape and club never appear to be quite black; two or three segments of the abdomen are usually obscurely reddish. On some of them the front coxae appear to be in actual contact, but when viewed from behind they may be seen to be slightly separated.

MANDALOTUS GYMNOGASTER sp. nov.

♂ Black; antennae and legs more or less reddish. Densely clothed with muddy-brown, variegated with greyish scales, and rather sparsely interspersed with subcrect setae; under surface sparsely clothed.

Rostrum moderately short and curved; median carina usually distinct throughout. Antennae thin. Prothorax slightly transverse, sides strongly rounded, median line traceable; with numerous fairly large granules, traceable before abrasion. Elytra feebly trisinuate at base, without posthumeral tubercles, alternate interstices feebly elevated; with rows of large punctures, wider than interstices, but appearing much smaller through clothing. Basal segment of abdomen with a rather deep, shining impression, continued on to metasternum. Front coxae almost touching; tibiae rather thin, apex not very acutely spurred. Length, 2·75–3·5 mm.

♀ Differs in being wider, abdomen and metasternum not excavated, and antennae and legs shorter.

Hab. Victoria: Lakes Entrance in October (F. E. Wilson). Type, I. 15972.

The cavity on the under surface is somewhat as on *M. foveatus*, but that is a considerably larger species, with front coxae more widely separated. No part

of the antennae is black, or even very dark, but the funicle is usually paler than the other parts; the legs are sometimes entirely reddish, but usually the femora are black, except at their ends; the tibiae are occasionally partly dark; the apical segment of the abdomen is usually reddish. On an occasional specimen there is a fairly distinct pale spot on the basal thickening of the third interstice, and several more about the summit of the apical slope, but on most specimens the variegation is feeble and ill-defined. From directly above the elytra appear to be almost evenly arcuate at base, but from most points of view the thickening of the third interstice causes the base to appear trisinuate, more noticeably on the female than on the male.

MANDALOTUS ALPINUS sp. nov.

♂. Black, antennae, parts of legs and apical segments of abdomen more or less reddish. Densely clothed with muddy-brown, feebly variegated scales, and interspersed with subercct setae, the latter confined to a single row on each interstice of elytra.

Rostrum rather short and curved; median carina traceable throughout. Antennae rather long and thin. Prothorax almost as long as wide, sides strongly rounded; with rather large close-set granules, traceable before abrasion. Elytra feebly trisinuate at base, without posthumeral tubercles, alternate interstices feebly elevated; with rows of large punctures, wider than interstices, but appearing much smaller through clothing. Basal segment of abdomen and metasternum with a conjoint but rather shallow depression. Front coxae touching, tibiae thin and feebly spurred. Length, 4 mm.

Hab. Victoria: Alps (Rev. T. Blackburn). Type, I. 15973.

In the 1914 table this species could be associated with *M. coxalis*, from which it differs in having smoother elytra and the prothorax less transverse, with larger but less conspicuous granules; these are feebly transversely arranged on the sides, but not elsewhere. Structurally it is close to the preceding species, but differs in being larger, under surface moderately clothed, and its depression much shallower. On two, of the three, specimens taken by Mr. Blackburn the scales on the head have a slight golden lustre, and even on the elytra a gleaming scale is occasionally evident.

MANDALOTUS POSTCOXALIS sp. nov.

Fig. 78, k.

♂ Black, funicle and tarsi reddish, rest of antennae darker. Densely clothed with muddy-brown or sooty scales, sometimes slightly variegated, and interspersed with numerous subercct setae.

Rostrum short, stout, and curved; median carina distinct in front, but normally concealed elsewhere. Antennae rather thin. Prothorax moderately transverse, sides strongly rounded; with large granules, distinct before abrasion; median line distinct. Elytra trisinuate at base, posthumeral projection prominent; surface uneven or subtuberculate, especially about summit of apical slope; with rows of large punctures, appearing much smaller through clothing. Basal segment of abdomen with a wide, shallow depression, continued on to metasternum. Front coxae widely separated, hind ones with a blunt tubercle; apical half of hind tibiae arcuately thinned on inner side. Length, 4–5 mm.

♀ Differs in having prothorax smaller and elytra wider, under parts not depressed, hind coxae unarmed, and hind tibiae less thinned inwardly.

Hab. Victoria: Eltham in April, August and September, Belgrave in January, Melbourne in July, Evelyn in May, Ringwood in July and September, Ferntree Gully in January (F. E. Wilson), Gippsland (J. E. Dixon). Type, I. 15961.

The armature of the hind coxae is not distinct from some directions, but on looking at a specimen along the middle the projections are clearly visible. The distance between the front coxae is about the width of a coxa. On some specimens parts of the under surface and of the legs, in addition to the tarsi, are obscurely reddish. On many the clothing of the upper surface is uniformly sooty or almost so, occasionally it is fawn-coloured; but on one of the Gippsland males there is a distinct whitish spot on the thickened base of the third interstice on each elytron, and five fairly distinct pale spots on the pronotum.

MANDALOTUS HOPLOCNEMUS sp. nov.

Figs. 78, 1; 80, r.

♂ Black, antennae and tarsi more or less reddish. Densely clothed with muddy-brown scales, interspersed with suberect setae; under surface sparsely clothed.

Rostrum stout and strongly curved; median carina not traceable. Antennae rather long and thin. Prothorax as long as wide, sides strongly rounded; with close-set granules, distinct before abrasion. Elytra feebly trisinuate at base, posthumeral prominence very feeble, alternate interstices feebly elevated; with rows of large punctures, appearing much smaller through clothing. Basal segment of abdomen feebly depressed in middle towards base. Front coxae very widely separated, the middle ones much closer together; front tibiae with a distinct tooth on inner side at basal third. Length, 3 mm.

Hab. South Australia: Mount Lofty Ranges, in moss (N. B. Tindale). Type, I. 15970.

The armature of the front tibiae is nearer the base than in *M. avenaceus*, with which the species could be associated in the 1914 table, and the front coxae are more than twice as widely separated as the middle ones, an unique feature in the subfamily. The funicle is decidedly paler than the rest of the antennae. A smaller (2·5 mm.) specimen is evidently immature, as it is (except for the clothing) entirely flavous, the tooth on its front tibiae is present, but smaller than on the type, and one of its deciduous mandibular processes is present.

MANDALOTUS IMPONDEROSUS sp. nov.

Pale castaneous. Moderately clothed with muddy-grey slightly variegated scales, interspersed with subercct setae; under surface sparsely clothed.

Eyes very large. Rostrum short and curved, median carina not traceable. Prothorax moderately transverse, sides strongly rounded; granules normally inconspicuous. Elytra conjointly arcuate at base, without posthumeral prominences, alternate interstices not elevated; with rows of large punctures, appearing much smaller through clothing. Basal segment of abdomen shining and slightly convex in middle. Front coxae almost touching, tibiae feebly spurred. Length, 1·5 mm.

Hab. Queensland: Mount Tambourine, from fallen leaves, in January (A. M. Lea). Type (unique), I. 15976.

The type is probably a female, as I cannot find any distinctly masculine features on it, and the abdomen is slightly convex. It was described, however, as its minute size should prevent its being confounded with any previously named species. It is decidedly smaller even than *M. microscopicus*, wider in proportion, and with much larger eyes; the distance between these at their nearest approach is less than the diameter of one of them. Although its derm is entirely pale, it is by no means certain that the type is immature, as its eyes are black, and the deciduous mandibular processes have been shed. Only a slight part of the pronotum was abraded, but this indicates that the granules are less evident than on most species of the genus.

MANDALOTUS COLLARIS sp. nov.

♂ Black, some parts obscurely reddish, funicle and tarsi paler. Densely clothed with muddy-brown scales, somewhat variegated in parts; with stout and not very dense setae scattered about, and becoming longer and more numerous on legs.

Rostrum short and stout, apparently without median carina, with an elevated subtriangular space commencing at the inter-ocular fovea and dilated to insertion of antennae. Antennae rather long and thin; scape somewhat curved; second

joint of funicle longer than first. Prothorax moderately transverse, sides and disc irregular. Elytra wider than prothorax, surface very uneven, shoulders produced; with very irregular rows of not very large punctures. Front coxae widely separated; femora stout; tibiae rather long. Length, 5–6 mm.

♀ Differs in being somewhat wider, two basal segments of abdomen gently convex in middle (instead of flat), and legs somewhat shorter.

Hab. Lord Howe Island (A. M. Lea and wife). Type, I. 5802.

In the 1914 table of the genus this species could be associated with *M. irrasus* and *M. ferrugineus;* but the sides of its prothorax and shoulders readily distinguish it from all previously described species. On some specimens the paler scales are but little in evidence, but on others they are very distinct and stramineous, with a faint golden gloss; on several the paler scales are conspicuous on the middle of rostrum from apex to base, and are continued on to head, where they form a conspicuously bilobed basal patch, on the prothorax they form fourteen small spots (four at the apex, four in the middle, two on each side, and two at the base, and four at the base of elytra. Each side of the prothorax is irregularly bilobed, the posterior lobe being usually feebly semi-double; between it and the base the side is strongly incurved to allow room for the projecting shoulder, the surface is irregularly elevated, rather than distinctly granulate or subtuberculate, and the median line is shallowly impressed. The elytra are supplied with numerous rather large, obtuse tubercles, of which there are usually four on the third interstice, three on the fifth, and four or five on the seventh; the humeral projection is oblique and usually semi-double; the suture is thickened at the summit of the apical slope; the rows of punctures are all deflected by the tubercles. Seven specimens were obtained from fallen leaves.

MANDALOTUS BILOBICOLLIS sp. nov.

Fig. 79, f.

♂ Blackish-brown, some parts obscurely reddish; funicle and tarsi paler. Densely clothed with muddy-brown scales, interspersed with stout setae.

Rostrum short and stout. Antennae long and thin. Prothorax moderately transverse, sides conspicuously bilobed. Elytra somewhat as in preceding species Front coxae touching. Length, 4·25 mm.

Hab. Lord Howe Island (A. M. Lea and wife). Type, I. 5804.

Strikingly close in general appearance to the preceding species, but with front coxae touching, instead of widely separated; the intercoxal process of the mesosternum is somewhat rounded, and about as long as wide; on the preceding species it is fully twice as wide as long. The prothorax is somewhat flatter than

on *M. collaris*, with the subtubercular elevations less pronounced, and sides conspicuously bilobed, the posterior lobe is more acute than the other, and not semi-double, between it and the base the side is more largely scooped out than on *collaris*, so that the projecting shoulder has more room; the elytra are more narrowed posteriorly, the tubercular elevations are more obtuse, and the rows of punctures are less conspicuously deflected by them. The rostrum at a glance is much as on *collaris*, but the elevated inter-antennary space is parallel-sided instead of triangular, and the apical plate is larger; the antennae are slightly thinner, but otherwise much the same. Two specimens were obtained from fallen leaves, and there is another, from Mount Ledgbird, in the Australian Museum.

MANDALOTUS SQUAMOSUS sp. nov.

♂ Blackish-brown, some parts obscurely reddish. Densely clothed with light brown or slaty-grey scales, on the under surface and appendages mixed with fine setae.

Eyes small, each encircled by a narrow but rather deep impression. Rostrum stout, dilated to near apex, transversely impressed at base, feebly bicarinate on upper surface. Antennae long but not very thin, second joint of funicle much longer than first. Prothorax almost as long as wide, sides moderately rounded, sculpture more or less concealed. Elytra wide, shoulders feebly produced and oblique; with semi-double rows of large, partially concealed punctures. Legs stout; front coxae slightly separated. Length 5·5–6·5 mm.

♀ Differs in being wider, shoulders less prominent, two basal segments of abdomen convex in middle instead of flat, and legs somewhat shorter.

Hab. Lord Howe Island (A. M. Lea and wife). Type, I. 5803.

The front coxae, although close together, are not touching, consequently in the 1914 table of the genus the species could be associated with *M. spureus;* but it is in fact very distinct from all previously described species of the genus. The ocular lobes are feeble but quite distinct from below. The claw-joints and the funicle are redder than the other parts, but are not brightly castaneous as on most species. The scales are of almost even colour throughout, but vary in shade amongst the individuals; on the prothorax there are no setae, and on the elytra but few, and those confined to the apical slope. The flanks of the prothorax are covered with dense and rather large punctures quite distinct before abrasion, but the disc through the clothing appears covered with very feeble tubercles, on abrasion, however, many large punctures are in evidence; the median line is rather feeble. The elytral punctures before abrasion appear to be narrower than the interstices, but after abrasion are seen to be wider; the interstices are not separately convex, except on the apical slope, where the alternate ones are feebly elevated above their fellows; the sides are rather suddenly narrowed

behind the shoulders on the male, but less conspicuously so on the female, and the shoulder of the male from below appears subtuberculate. Three specimens were obtained, one from the sea-beach at night.

MANDALOTUS HOWENSIS sp. nov.

♂ Reddish-brown, some parts (including the antennae and tarsi) paler. Densely clothed with stramineous or light brown scales, obscurely mottled with paler and darker spots and patches; with stout, depressed setae on upper surface, and longer and more numerous ones on under surface and legs.

Rostrum short and stout, median carina not traceable through clothing. Scape stout; first joint of funicle slightly longer and thicker than second, the others subglobular, but seventh distinctly transverse. Prothorax not much wider than long, sides and base rather strongly rounded. Elytra subovate, base arcuate, shoulders rather strongly rounded and widest at basal fourth; with regular rows of rather large punctures, appearing very small before abrasion; interstices scarcely separately convex, and not alternately elevated. Legs rather stout, front coxae almost touching. Length, 4·75–5·25 mm.

♀ Differs in being somewhat wider, two basal segments of abdomen slightly convex (instead of quite flat in middle) and legs somewhat shorter.

Hab. Lord Howe Island (A. M. Lea and wife). Type, I. 5828.

In some respects close to *M. ammophilus*, but with clothing more variegated and setae less conspicuous, rostrum not suddenly elevated above head at base, although gently separately convex (as viewed from the side), and scape somewhat thinner. In colour of clothing it approaches *M. crassicornis*, but that species has the scape almost twice as stout, and with a distinct median line on prothorax, of which, (at any rate before abrasion) there is not a trace on the present species; there are also many other differences; *M. herbivorus* has also the scape stouter, and different prothoracic and rostral sculpture. The scape is certainly of considerable thickness, but is less so than any of the species standing under H *nu* in the 1914 table of the genus. The general appearance of the prothorax and elytra is that of some of the more rusty-looking specimens of *M. sterilis*, with which, however, it has scarcely anything else in common. On the elytra the darker spots are fairly numerous and distinct; on two specimens there is a conspicuous dark patch on each side of the prothorax about the base, and rendered more conspicuous by a dark patch on each side of it; on these two specimens also the abdominal scales are mostly dark rusty-brown, becoming paler at the sides. On the elytra the setae form a more or less regular row on each interstice. On abrasion the prothorax is seen to be closely covered with small punctures, and with many of larger size; granules are absent. Four specimens were obtained, including two from fallen leaves.

MANDALOTUS MICROPS sp. nov.

♂ Dark brown (sometimes almost black), appendages and tip of abdomen reddish. With dense muddy-brown clothing, interspersed with stiff, recurved, yellowish setae; under surface much more sparsely clothed, and in places almost, or quite, glabrous.

Eyes very small, each enclosed by a narrow, deep impression, opening in front into the scrobe. Rostrum short, with an obscure median line; apical plate not triangular. Scape stout, moderately curved; first joint of funicle rather stout, as long as second and third combined. Prothorax almost as long as wide, sides obliquely increasing in width from base to apical third, and then oblique to apex; with four very obtuse elevations across widest part, and feeble granules (concealed before abrasion) elsewhere. Elytra moderately long and subovate, base trisinuate, widest slightly beyond the middle; with rows of large punctures, almost or quite concealed before abrasion; interstices feebly and almost regularly elevated in places. Abdomen with a basal row of large punctures. Front coxae touching; femora rather stout; tibiae thin; claw-joint long and thin. Length, 2–2¼ mm.

♀ Differs in having the prothorax more transverse, elytra larger, abdomen larger and more convex, and legs somewhat shorter.

Hab. Lord Howe Island (A. M. Lea and wife). Type, I. 5805.

The slight inequalities of the elytra could hardly be regarded as tubercles, but treating them as such the species, in the 1914 table of the genus, could be associated with *M. campylocnemis*, which is a much larger and otherwise very different species. Some specimens appear to have no part of the derm black, and these, regarding the elytra as nontuberculate, could be associated with *M. pallidus* (a much larger and otherwise different species); the others could be associated with O *H*, all small species, but all very different from the present one. Some specimens have the derm almost entirely pale castaneous, the under surface and appendages conspicuously so, on account of their sparser clothing. The general appearance of specimens is frequently altered by an incrustation of mud, but on clean ones, under a lens, the upper surface appears to be densely squamose, under a compound power, however, it is seen to be densely covered with fine setae, with considerably stouter ones scattered about; under a compound power also the abdomen is seen to be densely covered with small punctures and fine golden setae, but under a lens it appears shagreened, and the setae have an appearance as of short pieces of fine, spirally twisted silk. The rostrum has its basal two-thirds densely clothed, with the median carina of other species replaced by a narrow impressed line. Fifteen specimens were obtained from fallen leaves.

MANDALOTUS NODIPENNIS sp. nov.

♀ Dark reddish-brown, appendages and tip of abdomen paler. With dense muddy-brown, variegated with ashen, clothing; and with a few stout setae scattered about.

Head and its appendages and the legs much as on preceding species. Prothorax rather strongly transverse, sides feebly dilated in width from base to near apex; surface somewhat uneven, but derm concealed by clothing. Elytra subovate, base trisinuate, sides rather strongly rounded; punctures normally concealed; interstices with regular series of small nodes. Length, 2¼ mm.

Hab. Lord Howe Island (A. M. Lea and wife). Type, I. 5667.

A single specimen was obtained, and for some time was mixed with members of the preceding species, from which, however, it differs in having the prothorax more transverse, with the sides more rounded, the elytra shorter, with numerous small but distinct nodes, a few of which have stout setae (differently coloured from those of the preceding), but the majority of which have not: the scape is stouter and the two basal joints of funicle are thinner and longer (the others are missing). As its abdomen is distinctly convex the type appears to be a female, but as the species is certainly different from the preceding one, and is an island form, extremely unlikely to occur on the mainland, it has been named. On the type the clothing, which has nowhere been abraded, has a somewhat spotted appearance, owing to that on the elevated parts being ashen: as on the preceding species, it consists of fine setae, but with a squamose appearance under a lens, the stouter setae are sparse, even on the legs.

MANDALOTUS NORFOLCENSIS sp. nov.

♂ Blackish; antennae (club infuscated), legs, and tip of abdomen reddish. With dense, muddy-brown clothing, interspersed with numerous stout setae, thinner but not longer on legs than on elytra.

Rostrum short, median carina not traceable. Scape moderately long and rather thin, distinctly curved; first joint of funicle as long as three following combined. Prothorax slightly transverse, sides obliquely dilated from base to apical third; surface uneven. Elytra distinctly wider than prothorax, surface very uneven. Front coxae touching; femora rather stout; tibiae rather long and thin. Length, 2·25–2·5 mm.

Hab. Norfolk Island (A. M. Lea). Type, I. 5806.

This was the only species of the genus I obtained on Norfolk Island, although they were keenly searched for, and much sieving was done. Its nearest allies are *M. microps* and *M. nodipennis*, from Lord Howe Island, but it differs from

them in its rougher sculpture, and differently setose elytra; the claw-joint is also shorter. In the 1914 table of the genus the species could be associated with *M. campylocnemis*, which is a very much larger and otherwise different species. The elytral setae are confined to the elevated parts, and are more conspicuous on the apical half than on the basal; on the under surface many of the scales have a metallic-green gloss. The eyes are small but distinctly larger than on *microps;* on one specimen the base of the rostrum is conspicuously impressed at its junction with head, and the inter-ocular fovea appears narrow and deep, and continued on to base of rostrum, but on the other the inter-ocular fovea is not traceable through the clothing. The prothorax has numerous small granules, and four of larger size across the middle, with numerous punctures, but all more or less concealed by the clothing. Seen from in front the base of the elytra appears to be arcuate, from behind rather strongly trisinuate; there are numerous subtubercular elevations, but these appear to be in oblique rather than longitudinal series, and the punctures are large, but both punctures and elevations are greatly obscured by the clothing. Two specimens were obtained from fallen leaves.

STUDIES IN AUSTRALIAN AQUATIC HEMIPTERA
NO. VII

BY HERBERT M. HALE

Summary

Although the word "aquatic" may be legitimately applied to insects which live on the surface of the water, or which frequent the margin of waters, forms living in such situations are often referred to as having a "semi-aquatic" habit, in contradistinction to species which swim beneath the surface film.

The types of the species herein described as new have been placed in the Museum.

STUDIES IN AUSTRALIAN AQUATIC HEMIPTERA

No. VII[1]

By HERBERT M. HALE.

Text figures 81-90.

ALTHOUGH the word "aquatic" may be legitimately applied to insects which live on the surface of the water, or which frequent the margin of waters, forms living in such situations are often referred to as having a "semi-aquatic" habit, in contradistinction to species which swim beneath the surface film.

The types of the species herein described as new have been placed in the Museum.

GYMNOCERATA.

The members of the five families placed in this division are semi-aquatic in habit; representatives of three of the families have been previously described from Australia, and a member of each of the others is herein recorded. The families are readily separated as follows:

KEY TO FAMILIES.

a. Form not linear: head shorter than thorax.
  b. Claws placed at end of tarsi, the last joint of which is entire.
    c. Body robust; tarsi two-jointed. (Antennae five-jointed in our genus) .. .. .. *Naeogeidae.*
    cc. Body rather slender; tarsi three-jointed and antennae four-jointed .. .. .. *Mesoveliidae.*
  bb. Claws of front tarsi (at least) not apical, but inserted in a nick or cleft in the terminal tarsal joint.
    d. Rostrum three-jointed .. .. *Veliidae.*
    dd. Rostrum four-jointed .. .. *Gerridae.*
aa. Form linear; head as long as thorax .. .. *Hydrometridae.*

Some authors reduce the last four families to the status of sub-families of the Hydrometridae; and some exclude the family Naeogeidae from the Gerroidea, placing it elsewhere in the Gymnocerata.

FAMILY NAEOGEIDAE.

The tiny bugs belonging to this family are found near water, but rarely

(1) No. v in Archiv f. Zool., K. Svenska Vet.-Akad., xviiA, 1925, No. 20; No. vi in Proc. Linn. Soc., N.S. Wales, xlix, 1924, p. 461 to 467.

venture on the surface film. Four genera are known, and the various species have been taken beneath leaves or in tufts of vegetation bordering the water, on rocks in mid-stream, and walking on the water. In the members of this and the next family the tarsi are not so perfectly modified for walking on the surface-film as in those of the Veliidae.

I have followed Horvath [2] in placing the Naeogeidae in the superfamily Gerroidea; Jaczewski *(ut infra)* considers that the structure of the male genital segments in *N. ruficeps* Thoms. indicates that the family is more nearly related to the Myodochidae (Lygaeidae) and Pyrrhocoridae.

NAEOGEUS Laporte.

Naeogeus Laporte, Essai. Hémip., 1832, p. 34; Jaczewski, Bull. Ent. Pologne, i, 1922, p. 13.

Hebrus Curtis, Ent. Month. Mag., i, 1833, p. 198; Amyot & Serv., Hem., 1843, p. 294; Fieb., Europ. Hem., 1861, p. 32 and 104.

Type, *Lygaeus pusillus* Fallen (*Naeogeus erythrocephalus* Laporte).

The body is plump, and the legs are stout and placed widely apart on the sternum; the tarsi bear curved, terminal claws. The antennae are five-segmentate, with an auxiliary jointlet at the base of the flagellum (third to fifth segments) and a tiny, collar-like jointlet between the first and second flagellal segments. As far as is known the adults are always winged.

NAEOGEUS LATENSIS sp. nov.

♂ Form broad, not narrowed posteriorly, about two and one-fourth times longer than greatest width. Head, pronotum, and scutellum dark brown, shot with metallic blue and green reflections, finely pilose. Head about as long as first two joints of antennae. Antennae testaceous, in parts darkened; as long as head and pronotum together; first segment longer than second, and as long as third without basal jointlet; second and fourth, and third and fifth segments subequal. Pronotum less than twice as wide as its median length, much longer than head; humeral angles tumid, prominent, and rounded; a discal fovea margined with a few coarse punctures; a line of punctures bordering the posterior edge and extending upwards along the inner side of the humeral tumidities. Keel of scutellum very distinct, not extending quite to posterior angle. Hemelytra almost reaching to termination of abdomen; clavus and corium velvety brownish-black, clothed with bright golden hairs; inner anterior angle of clavus with a large, elongate, sub-triangular spot; membrane greyish-brown, dull, with four

(2) Horv., Ann. Mus. Nat. Hungarici, xiii, 1915, p. 535-536.

indistinct pale spots. Rostrum testaceous, extending to level of posterior acetabula. Underside black, shining, clothed with dense pubescence between posterior coxae, but with sparse hairs on rest of sternum; ventral surface of abdomen with rather long, dense, golden pubescence. Legs testaceous, with the apices of femora and tarsi, and basal third of tibiae, darkened. Anterior femora equal in length to the tibiae, which are about two and one-half times as long as

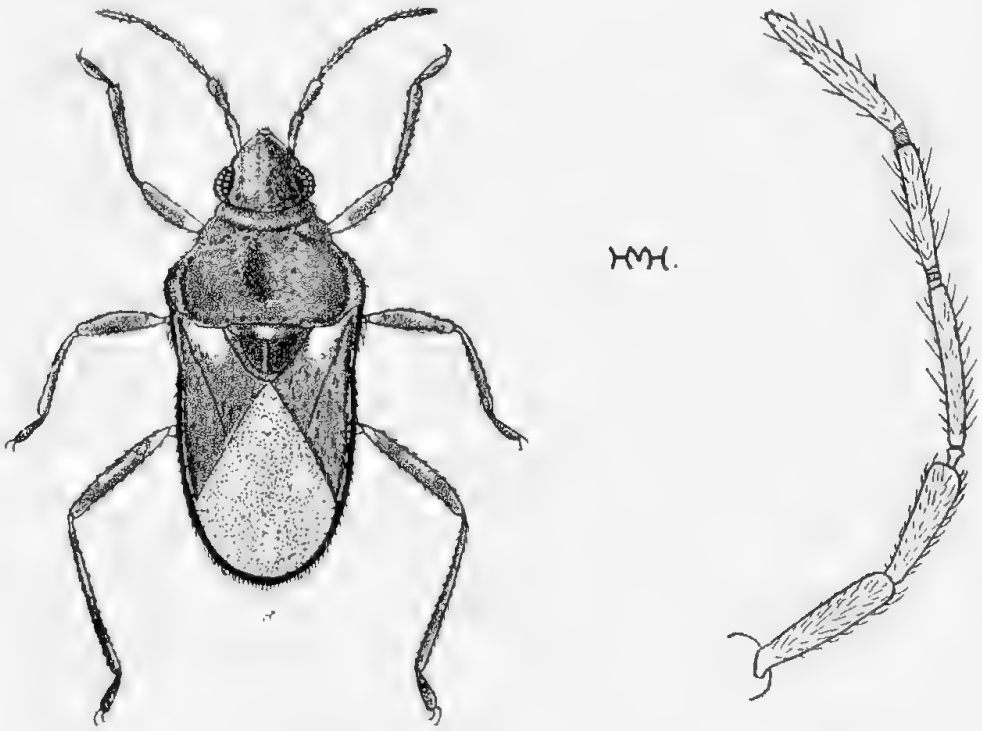

Fig. 81. *Naeogeus latensis*, male.

tarsi. Intermediate femora a little shorter than tibiae, which are almost three times as long as tarsi. Posterior tibiae longer than femora and more than three times as long as tarsi.

♀ A little more robust than the male.

Length, 1·3 mm. to 1·95 mm.; width, ·6 mm. to ·85 mm.

Hab. South Australia: Adelaide (type loc.) and Myponga Swamps (H. M. Hale); Tasmania: Devonport (A. M. Lea); New South Wales: Glenfield (A. M. Lea).

This beautiful little bug is the first of the family to be recorded from Australia; it somewhat superficially resembles *N. bombayensis* Paiva, but differs in the proportions of the antennal segments.

N. latensis may be found in numbers at the base of grass tufts bordering our creeks, and is easily obtained by shaking tussocks over a white sheet.

In perfect examples the sculpture of the pronotum is almost or quite hidden by the pubescence, and the head, pronotum, and scutellum appear metallic bluish-green; the underside is sometimes sprinkled with tiny spots of similar colour.

FAMILY MESOVELIIDAE.

Most of the representatives of this small family run on the surface film of quiet waters, but a species from New Guinea, *Phrynovelia papua* Horvath ([3]), was not found on water, but on fallen leaves in the forest.

No *Mesoveliae* are included in the material I have examined from the Australian museums, although, at least in certain localities, the species described below is anything but rare.

MESOVELIA Mulsant and Rey.

Mesovelia Muls. & Rey, Ann. Soc. Linn. Lyon, 1852, p. 138; Horv., Ann. Mus. Nat. Hungarici, xiii, 1915, p. 543 (refs.).

Fieberia Jak., Trudy Russk. Ent. Obshtsh., vii, 1874, p. 32.

Type, *M. furcata* Mulsant and Rey.

MESOVELIA HUNGERFORDI sp. nov.

Apterous ♂. Form narrowly sub-oval, widest at metathorax, three and two-thirds times longer than wide. Head greenish, with a black marking anteriorly, with a brown, longitudinal, median line, and with three pairs of setiferous black dots, two pairs in front of eyes and one pair near posterior margin; clothed with black hairs over greater part of dorsum, and with whitish hairs anteriorly; an outstanding black seta in front of each eye; medial length greater than width, including eyes. Antennae brown, pilose, reaching back to posterior margin of sixth abdominal segment; first segment with two setae not far from apex; about one-third as long again as second, and nearly as long as third, which is subequal in length to fourth segment. Notum greenish, in parts faintly marked with brown; clothed with short black hairs; pronotum with a very slightly oblique, shallow fovea on each side; medial length of mesonotum greater than that of pronotum and twice the medial length of metanotum. Abdomen green, with lateral margins of connexivum and sutures brown; clothed with short brown hairs, which merge into longer and denser hairs on genital segments; sutures of first two segments not well defined, but nevertheless distinctly visible. Connexivum sub-horizontal. Rostrum greenish-ochraceous, with apical fifth

(3) Horv., *loc. cit.*, p. 535, 555, fig. 9.

black; reaching to between anterior margins of hind coxae. Underside pilose, greenish-ochraceous, the abdomen in parts darkened; first genital segment with two large, slightly oblique ridges, each elevation about one-half as long as the segment and bearing short brown spines. Legs long, pale beneath and brownish above, with tarsi and apices of femora and tibiae brownish-black; clothed with

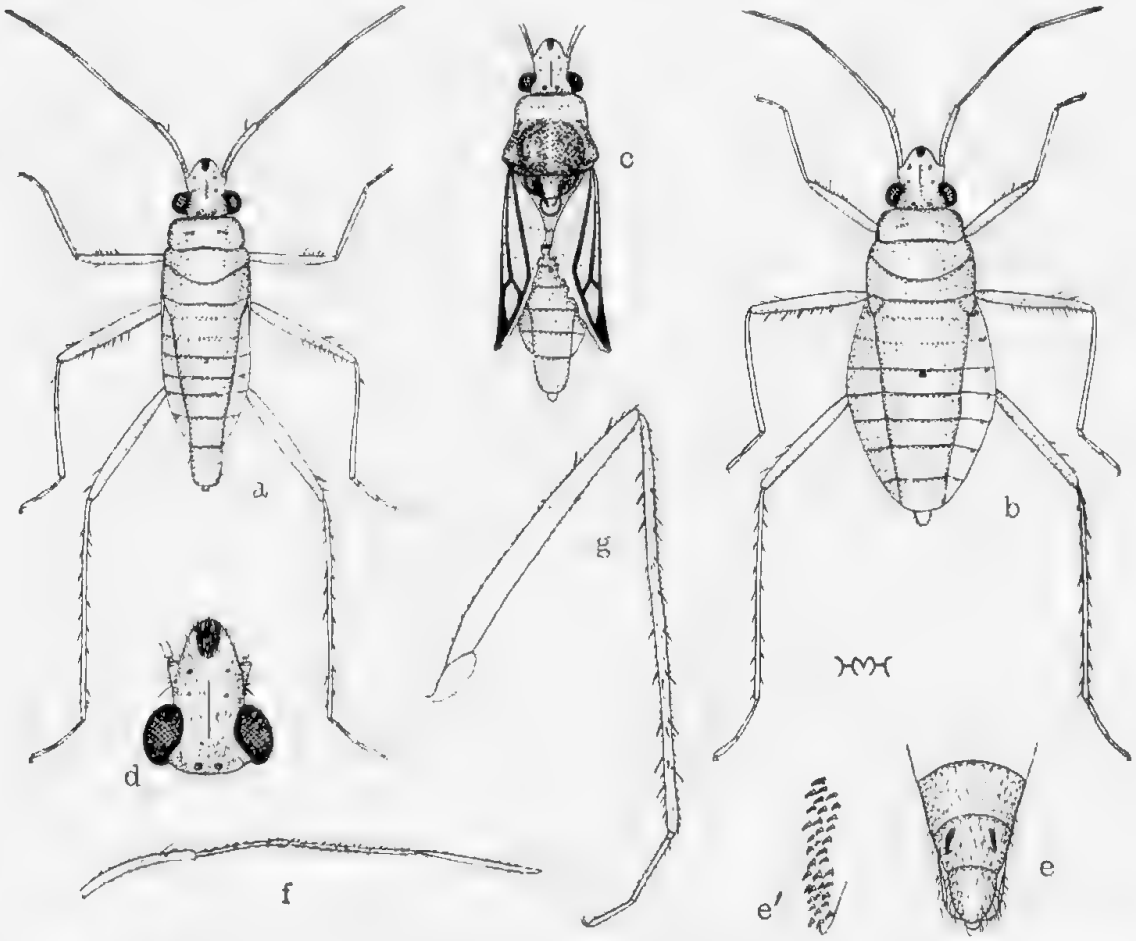

Fig. 82. *Mesovelia hungerfordi*; *a* and *b*, apterous male and female; *c*, macropterous male with mutilated hemelytra; *d*, front view of head of macropterous male; *e*, ventral view of genital segments of male; *e'*, one of the ventral elevations further enlarged; *f* and *g*, antenna and posterior leg of male.

short, stiff, brown hairs. Anterior femora with two setae on upper side near apex and several on underside; one-fourth longer than tibiae, which are about two and one-half times as long as tarsi; second segment of tarsi slightly shorter than third. Intermediate femora with two setae on upper side near apex and a row of setae on underside; subequal in length to tibiae, which are more than two and one-half times as long as tarsi; second tarsal segment a little longer than third. Posterior femora with two setae on upper side and none below; with

apices reaching well beyond tip of abdomen; tibiae one-fifth as long again as femora and more than three times as long as tarsi, the second joint of which is nearly half as long again as third.

Length, 3·12 mm.; width, ·8 mm.

Apterous ♀. Form much wider, legs and antennae relatively shorter and with segments of slightly different proportions than in male. Sub-ovate, two and one-half times longer than greatest width. Antennae reaching back nearly to level of fifth abdominal segment and apices of posterior femora extending to tip of abdomen. Second segment of posterior tarsi more than half as long again as third segment. Connexivum much wider than in male.

Length, 3·72 mm.; width, 1·4 mm.

Macropterous ♂. Pronotum a little wider than its median length; anterior lobe greenish-ochraceous, with two shallow impressions as in apterous form; tumid posterior lobe brown, with four indistinct spots and a longitudinal median line, pale. Scutellum greenish-yellow, with a brown marking on each side. Veins of hemelytra black; clavus, corium, and anterior part of membrane white, tinged with smoky brown; corium with a distinct apical cell.

Macropterous ♀. Width of pronotum at humeral angles about one-third greater than medial length.

Hab. South Australia: Adelaide (type loc.), Myponga and River Murray (H. M. Hale); New South Wales: Sydney (A. J. Nicholson).

It gives me much pleasure to associate with this species the name of Dr. H. B. Hungerford, by whose courtesy I have been able to examine the species of *Mesovelia*, and other aquatic and semi-aquatic bugs from North America. *M. hungerfordi* belongs to the group of species in which the male has a pair of elevated tufts of brownish-black spines on the venter of the first genital segment (*M. thermalis* Horv., *M. mulsanti* B. White, and *M. subvittata* Horv.); the elevations, however, are much larger, more elongate, and are more widely separated in *M. hungerfordi* than in the other species in which they are present. *M. mulsanti* is of about the same size as the Australian species, but is more slender in form. The type specimens of *M. subvittata* (two macropterous males) were collected in New Guinea; this species has no apical cell in the corium. In *M. thermalis* the pronotum of the macropterous form has no pale longitudinal, median line; and the metanotum of the apterous form is relatively longer than in *M. hungerfordi*.

Our species at times occurs in great numbers on the backwaters and irrigation drains of the River Murray, particularly when the surface of the water is covered with floating water-plants (*Lemna* and *Azolla*). Winged adults are comparatively rare, and in such as I have, the membrane of the hemelytra is

mutilated. Macropterous examples of *M. mulsanti* have been observed to rip the membrane off the wings with the hind tibiae, and so expose the genital segments—presumably to facilitate copulation ([4]). Torre Bueno notes this habit in several American Gerrids ([5]).

FAMILY VELIIDAE.

The species of two Veliid genera, *Trochopus* and *Halovelia*, are marine, but the remainder inhabit fresh water; Kirkaldy ([6]) unites *Trochopus* with *Rhagovelia*, but the two-jointed intermediate and posterior tarsi of the former separate them.

Structure. The body is plump, and the general shape in dorsal view is sub-oval, obovate, or sub-fusiform. The head is narrower than the pronotum, and the eyes are prominent, not very large, and exserted. The antennae are

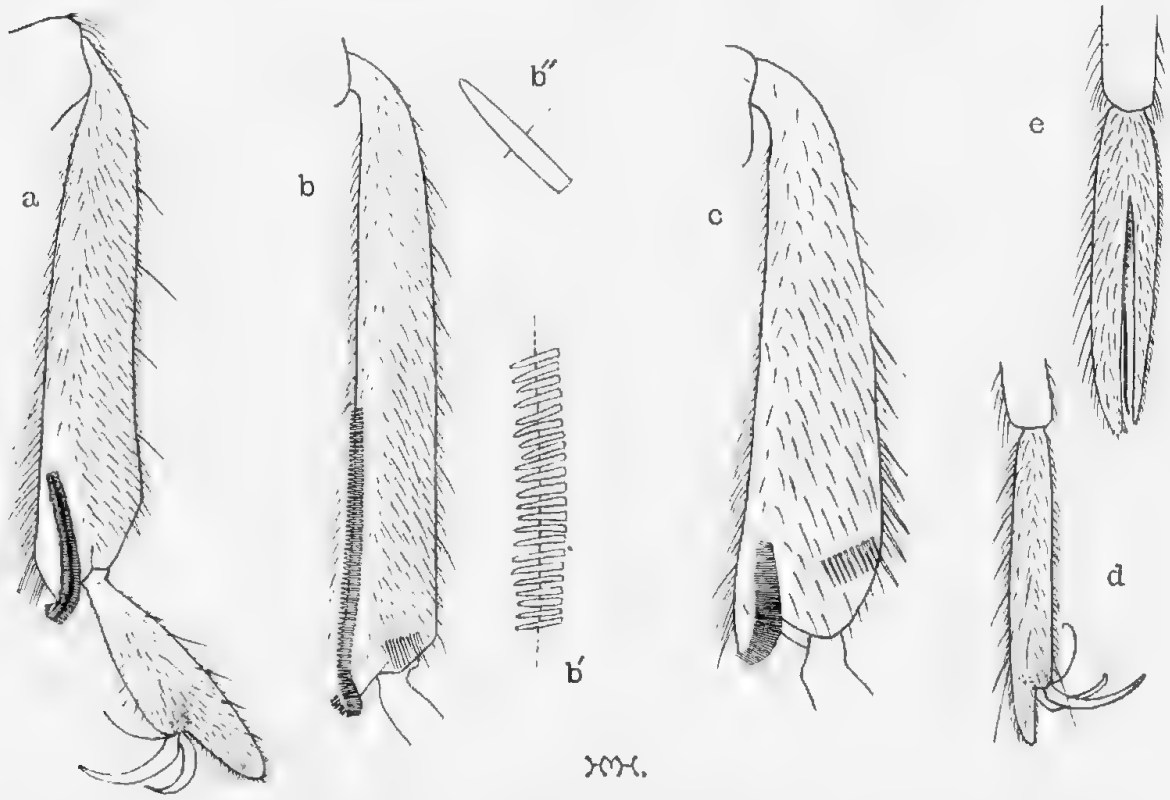

Fig. 83. *a*, Anterior tibia and tarsus of *Microvelia dubia*, male (100 diams.). *b*, Anterior tibia of *Microvelia howense*, male (100 diams.). *b′*, portion of tibial comb (315 diams.); *b″*, tooth of tibial comb (1,000 diams.). *c*, Anterior tibia of *Microvelia oceanica* (235 diams.). *d*, Terminal segment of intermediate tarsus of *Microvelia melancholica* (100 diams.). *e*, Terminal segment of intermediate tarsus of *Rhagovelia australica* (40 diams.).

([4]) Hungerford, Psyche, xxiv, 1917, p. 80.
([5]) Bueno, Ohio Nat., ix, 1908, p. 389-392.
([6]) Kirk., Boll. Mus. Torino, xiv, 1899, p. 5.

four-segmentate, and, in at least the Australian representatives, there is a tiny jointlet at the base of the flagellum (third and fourth segments). This jointlet allows the two-segmented flagellum greater freedom of movement; in the descriptions it is included in the length of the third segment of the antennae. In *Halovelia* and the species of *Microvelia* now examined, a rake or comb, much resembling an ordinary hair-comb, is developed on the inner side of the anterior face of the fore tibiae in the male (fig. 83, *a* to *c*, and fig 84, *c*). In this sex the apex of the inner side of the tibia is forwardly produced beyond the level of the articulation of the tarsus; the rake extends along the distal part of the inner margin of the tibia, and is more or less curved over the apex of the produced part. The tibia is not apically produced, and the comb is absent in the female. The length and shape of the comb varies in the species, and is therefore a character of specific importance; it is probably present in many other representatives of the family. The tarsi are modified to support the bugs on the surface film of water; the claws are not terminal, but are inserted in a cleft or nick before the apex, which is bluntly rounded and pilose (fig. 83, *a* and *d*). In *Trochopus* and *Rhagovelia* the long terminal joint of the intermediate tarsi is deeply split (fig. 83, *e*), and accommodates a fan-like arrangement of pinnate hairs; this fan, when expanded, assists in supporting the insects on the surface film, and enables them to run rapidly, even upon swiftly-moving waters. In many forms the hind legs are longer than the intermediate or anterior pair, while in others, as for instance *Rhagovelia*, *Halovelia*, *Trochopus*, and some species of *Velia*, the middle limbs are longest. Species of most of the genera are known from both apterous and winged adults, although it seems that apterous individuals are most commonly met with. It is probable that, as in *Halobates*, wings are never developed in the aforementioned marine genera.

Habits. Feeding is predatory, but the anterior legs are not raptorial. Small animals living on floating vegetation are speared by the long rostral stylets, and thus held at the tip of the rostral sheath while their juices are ingested by their captor; tiny aquatic animals which approach closely to the surface are similarly transfixed.

KEY TO AUSTRALIAN GENERA.

a. Intermediate and posterior tarsi three-jointed; ultimate segment of intermediate tarsi longitudinally split from apex .. .. *Rhagovelia.*

aa. Intermediate and posterior tarsi two-jointed; ultimate segment of intermediate tarsi not split.

b. Intermediate legs markedly longer than posterior pair .. .. *Halovelia.*

bb. Intermediate legs not markedly longer than posterior pair .. .. *Microvelia.*

RHAGOVELIA Mayr.

Rhagovelia Mayr., Verh. zool.-bot. Ges. Wien, 1865, p. 445; Sign., Ann. Soc. Ent. France, 1877, p. liv.

Baccula Stal, Hem. Afr., iii, 1865, p. 167.

Neovelia B. White, Jour. Linn. Soc., xiv, 1879, p. 487.

Type, *R. nigricans* Burmeister.

The characters given in the key to the Veliid genera serve to distinguish this genus. Only one species is recorded from Australia.

RHAGOVELIA AUSTRALICA Kirkaldy.

Rhagovelia australica Kirk., Proc. Linn. Soc., N.S. Wales, xxxii, 1907, p. 783.

I have seen two examples, with mutilated antennae, collected by Dr. Mjoberg.

Hab. Queensland: Kuranda (type loc.), Malanda (Mjoberg).

HALOVELIA Bergroth.

Halovelia Berg., Ent. Month. Mag., xxix, 1893, p. 277.

Type, *H. maritima* Bergroth.

In this genus the body is densely pilose, and in dorsal view the form is widely oval or ovate. The pronotum is very short and transverse, while the mesonotum is greatly enlarged and posteriorly is produced over the anterior part of the abdomen. The intermediate legs are markedly longer than the others; the tarsi of the intermediate and posterior limbs are two-segmented, and the claws of the middle pair are inserted very close to the apex.

Halovelia differs from the allied American genus *Trochopus* in not having the intermediate tarsi split and furnished with a fan of hairs, and in having the mesonotum very much larger, and the visible portion of the abdomen consequently smaller. The members of both genera are of marine or estuarine habit.

HALOVELIA MARITIMA Bergroth.

Halovelia maritima Berg., *loc. cit.*

♂ Form sub-oval, one and two thirds times longer than wide, and broadest at about middle of mesonotum. Head black, marked with brown on basal third; densely clothed with pale pubescence, intermixed with a few long hairs; large and prominent, including eyes slightly wider than anterior margin of pronotum. Eyes reddish-black, relatively small. Antennae black, with rather long, whitish pubescence; almost two-thirds as long as total length of insect; first segment thickened on distal half, curved, almost half as long again as second, and with bulbus small; fourth very slightly shorter than the first, stout and thick, elliptical

in shape; third segment shorter than fourth and longer than second. Pronotum black, brownish towards posterior margin; basal width five times medial length, which is little more than one-third the length of the head; anterior and posterior margins slightly curved, almost straight; lateral margins very oblique.

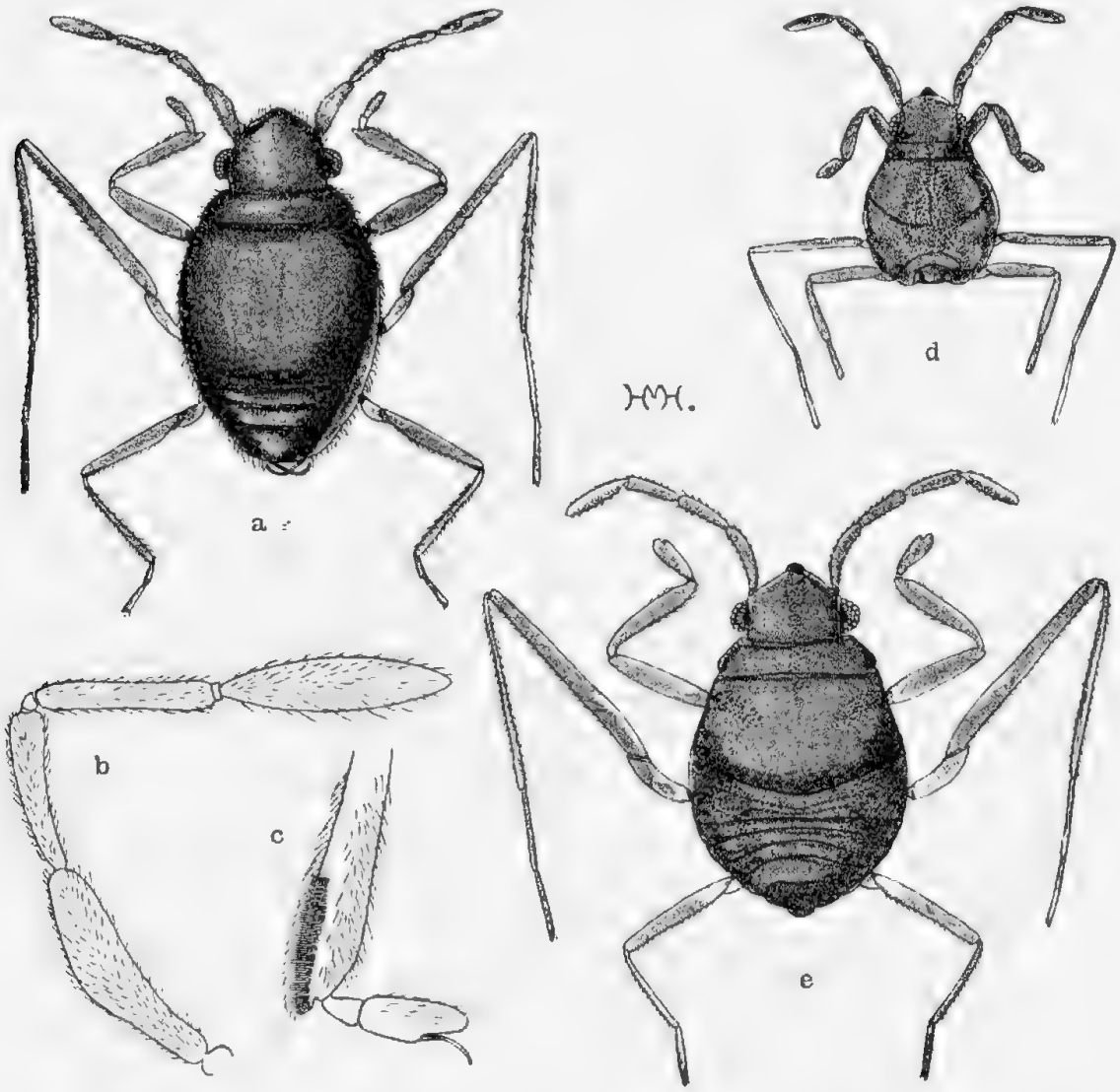

Fig. 84. *Halovelia maritima*; *a*, adult male; *b*, antenna; *c*, anterior tarsus and portion of tibia, showing comb; *d*, third (?) instar nymph; *e*, female of last nymphal instar. (*a*, *d*, and *e* are drawn to same scale.)

Mesonotum black, clothed with short, pale pubescence; very convex, and wider than long. Abdomen black above, densely and palely pubescent; subtruncate posteriorly; exposed portion slightly more than one-half as long as mesonotum; connexivum thick, with long pubescence on edges; slightly and obliquely elevated. Underside brown, merging into black laterally; clothed with whitish hairs, which

are dense and moderately long towards lateral margins, but are sparse on disc of sternum and abdomen. Basal joints and distal half of apical joint of rostrum black; remainder brown; apex reaching beyond anterior coxae. Legs brown, clothed with yellowish hairs; coxae of intermediate and posterior limbs widely separated. Anterior legs a little shorter, but stouter than last pair, which are but half as long as the intermediate pair. Anterior femora subequal in length to tibiae; distal end of outer side of tibiae closely set with stout, short setae; inner inferior margin apically produced, and, with a comb, consisting of about seventy teeth, occupying three-sevenths of its length; apex of tibiae bifurcate, and on outer part sloping obliquely away from articulation of tarsus; anterior tarsi less than one-half as long as tibiae; composed of three segments, the first minute and almost invisible, the second short and one-third as long as the stout terminal segment. Intermediate and posterior fulchra conspicuous, curved, projecting well beyond body. Intermediate tibiae scarcely shorter than femora and two-fifths longer than tarsi, the first joint of which is one-third longer than second. Posterior tibiae almost as long as femora and twice as long as tarsi, the second segment of which is nearly three-fourths longer than the first.

Length, 1·4 mm.; width, ·85 mm. to ·87 mm.

♀ Form widely ovate, not widest at middle of mesonotum. Size larger and connexivum wider than in male.

Length, 1·96 mm.; width, 1·2 mm.

THIRD (?) INSTAR NYMPH.

Fig. 84, *d*.

Form somewhat ovate, a little less than half as long again as wide; broadest behind mesonotum. Antennae stout, four-fifths as long as total length of insect; proportions of segments much as in adult, but basal jointlet of flagellum not apparent. Anterior legs very stout; tibiae not apically produced on inner side, less than twice as long as the single-jointed tarsus. Intermediate femora and tibiae equal in length; tibiae about one-third longer than tarsi, which (when cleared and mounted) appear somewhat obscurely two-jointed, the two segments subequal in length. Posterior legs short and moderately stout; femora scarcely longer than tibiae, which are more than half as long again as single-jointed tarsi. Clothing comparatively sparse.

Length, ·85 mm.; greatest width, ·575 mm.

FINAL NYMPHAL INSTAR.

Fig. 84, *e*.

♀ Form ovate, more than half as long again as greatest breadth; widest

behind mesonotum. Antennae moderately stout, slightly more than two-thirds as long as total length of insect; basal jointlet of flagellum very tiny. Anterior legs stout, tibiae not apically produced; tarsi unisegmentate, thickened towards apex, less than half as long as tibiae. Intermediate femora slightly longer than tibiae, which are one-third longer than tarsi; tarsi two-jointed, the first joint a little longer than second. Posterior femora longer than tibiae; tarsi single-jointed, more than one-half as long as tibiae. Clothing much more pronounced than in nymph previously described, but hairs of legs and antennae not so dense as in imago.

Length, 1·49 mm.; greatest width, ·925 mm.

Hab. Timor Sea: Cartier Island (type loc.); Western Australia: Pelsart Islands (A. M. Lea).

The type specimens of this interesting species were taken "under blocks of coral, below high-water mark" (7). Cartier Island is nearer to Timor than to Australia, being 175 miles from our north-western coast. Bergroth remarks that *H. maritima* "is probably the only insect of Cartier Island." The Houtmans Group is quite close to the mainland of Western Australia, and Mr. Lea captured the examples described above, under stones on a Pelsart reef, many years ago; four adult males, a damaged adult female, and two nymphs were preserved. The imagoes agree well with Bergroth's description, excepting that the segments of the posterior tarsi can scarcely be said to be "longitudine subaequalibus". The sex of the type is not stated, but in length (2 mm.) it agrees with the female now examined.

MICROVELIA Westwood.

Microvelia Westw., Ann. Soc. Ent. France, iii, 1834, p. 647; Amy. & Serv., Hem., 1843, p. 421; Doug. & Scott, Brit. Hem., 1865, p. 574; Sahl., Medd. Soc. Faun. Fl. Fenn., i, 1876, p. 88.

Hydrocssa Burm., Handb., ii, 1835, p. 213; Fieb., Europ. Hem., 1861, p. 33, 104; Stal., Hem. Afr., iii, 1865, p. 167.

Type, *Microvelia pulchella* Westwood.

These small black bugs are taken on quiet streams and backwaters, or on isolated pools, rather than on the surface of rapidly moving water. They have not been extensively collected in Australia, indeed few specimens are to be found in our museums. In 1916 Bergroth described *M. australica*, taken twenty years before by the Horn Expedition in Central Australia; this is the first record of the genus for our region. I have examined specimens taken by Dr. Mjoberg in the northern half of the continent, others captured by Mr. Nicholson in New

(7) See also Walker, Ent. Month. Mag., xxix, 1893, p. 229.

South Wales, a few collected by Mr. A. M. Lea, and those taken by myself in South Australia. Seven species are now listed for Australia.

Food. Bueno (8) fed *Microvelia americana* with flies, and Hungerford (9) describes in interesting detail the manner in which another American species (*M. borealis*) impales Ostracods by thrusting the beak between the hard valves of the crustaceans. Butler (10) suggests that, in the case of the European *M. reticulata*, "Pond water may possibly be sufficiently charged with organic matter to yield all the sustenance such minute insects need". This author notes the observations of Bueno and Hungerford, but remarks that "*M. americana* is much larger than our species". There is little doubt, however, that all species are carnivorous, and capable of subduing animals as large as themselves. Some notes on feeding are herein given for the two South Australian species, one of which, like *M. borealis*, is no larger than the aforementioned European species.

The Australian species may be separated by the structure of the antennae; also, as mentioned above, the anterior tibial comb of the male is a specific character of some interest. These are the main differences utilized in the following key. The "bulb of insertion" is not included in the length of the first segment of the antennae, and the basal jointlet of the third segment is included in the length of that segment.

KEY TO AUSTRALIAN SPECIES.

a. First segment of antennae distinctly longer than second.
  b. First segment of antennae longer than third.
    c. Fourth segment of antennae long, more than twice as long as second; anterior tibial comb of male less than one-fourth the length of inner margin of tibiae .. .. *oceanica.*
    cc. Fourth segment of antennae short, less than one-third longer than second; anterior tibial comb of male one-half the length of inner margin of tibiae .. .. *howensc.*
  bb. First segment of antennae not longer than third.
    d. Fourth segment of antennae more than two-thirds as long again as second segment; anterior tibial comb of male at least one-half the length of inner margin of tibiae.
      e. Form elongate; antennae long and slender; anterior tibial comb of male almost two-thirds the length of inner margin of tibiae .. .. .. *mjobergi.*

(8) Bueno, Can. Ent., xlii, 1910, p. 176.
(9) Hungerford, Bull. Univ. Kansas, xxi, 1919, p. 138.
(10) Butler, Biol. Brit. Hem.-Het., 1923, p. 239.

ee. Form stout; antennae shorter and stouter; anterior tibial comb of male little more than one-half the length of inner margin of tibiae .. .. *peramoena.*

dd. Fourth segment of antennae less than one-third as long again as second segment; anterior tibial comb of male less than one-third the length of inner margin of tibiae .. *dubia.*

aa. First segment of antennae shorter than, or subequal in length to, second.

f. First and second segments of antennae subequal in length; hemelytra whitish; rostrum scarcely passing prosternum .. .. *australica.*

ff. First segment of antennae shorter than second; hemelytra black; rostrum extending to middle of mesosternum .. .. *melancholica.*

MICROVELIA OCEANICA Distant.

Microvelia oceanica Dist., Nova Caledonia, Zool., i, 1914, p. 383, pl. xii, fig. 10-11.

Macropterous ♂. Narrow, widest across humeral angles of pronotum. Head black, dull, sparsely clothed with whitish pubescence, and with a patch of bluish pubescence alongside inner margin of each eye; obsoletely carinate, finely punctate, and with several large punctures forming a sub-marginal line

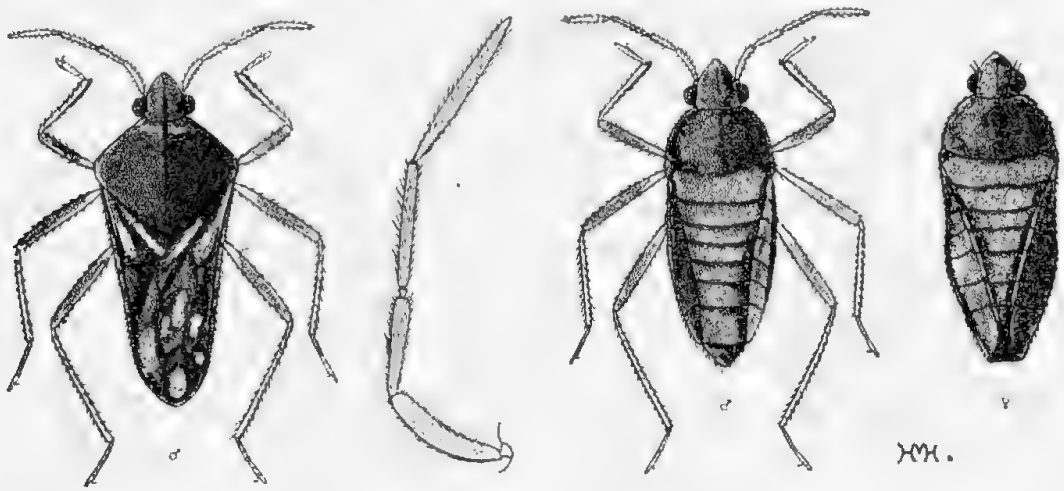

Fig. 85. *Microvelia oceanica*: macropterous male, and apterous male and female.

on each side. Antennae brown, darkened at apices of first to third segments and paler on proximal half of first; short and slender, not as long as head and pronotum together; first segment nearly one-fourth longer than second, subequal in length to third and about three-fifths as long as the fourth, which is more than twice as long as the second. Pronotum black, with posterior margin narrowly

bordered with dark ochraceous, and with an anterior sub-marginal fascia, not reaching to lateral margins, of same colour; clothed with pale pubescence; distinctly wider than long, and with an obsolete median carina and prominent humeral angles; surface dull, finely punctate, with a line of large punctures at hinder edge of anterior fascia, and another series sub-marginal and parallel to the posterior margin of pronotum. Hemelytra brownish-black, with a pair of luteous curved markings within central areole, a prominent milk-white spot within apical area, and a more or less distinct luteous streak within each remaining areole; not quite reaching to outer edges of connexivum and extending beyond apex of abdomen. Apical segment of rostrum almost black; face dark ochraceous. Rostrum reaching to between hinder edges of anterior coxae. Sternum and underside of abdomen black, with a bluish tinge; dull, clothed with very short, whitish pubescence. Legs slender; acetabula, coxae, and fulchra ochraceous. Anterior femora ochraceous, with apex brown; a little less than one-fourth longer than tibiae, which are one-half as long again as tarsi; tibial comb very short, occupying less than one-fourth of length of inner margin of tibiae. Intermediate and posterior femora ochraceous, with apices and a streak on distal two-thirds of upper and lower margins dark brown; rest of legs dark brown. Intermediate tibiae slightly shorter than femora and about half as long again as tarsus, the second segment of which is nearly half as long again as first. Posterior femora not nearly reaching to apex of abdomen, about one-seventh shorter than tibiae, which are a little more than twice as long as tarsi; second segment of tarsus one-third longer than first.

Macropterous ♀. Form slightly more robust than in male. Anterior tibiae about one-third as long again as tarsi.

Length, 1·7 mm. to 2·4 mm.; width, ·7 mm. to ·96 mm.

The hemelytra are very pale brown or whitish in some specimens, while in others they are almost wholly black with but faint indications of areolar markings.

Apterous ♂. Form sub-fusiform. Pronotum about twice as wide as medianly long. One or two genital segments visible; connexivum more or less erect.

Apterous ♀. Form wider than in male. Connexivum horizontal, erect or infolded over dorsum of abdomen, sometimes meeting over seventh abdominal segment.

Colour. Head as in winged form. Pronotum black, with posterior margin yellow or orange and with an anterior yellow or orange fascia, which in some specimens reaches to lateral margins, in others is narrow and medianly interrupted, and is occasionally covered with silvery pubescence. First dorsal abdominal segment black, brownish or (rarely) red, with or without bluish bloom on median line and posterior margin. Dorsum of each of remaining abdominal

segments wholly black, or with disc brown, varyingly marked with bluish bloom; segments five to seven sometimes with velvety black bloom on disc. Connexivum ranging from black to lemon-yellow with sutures brown; with or without bluish bloom. Sternum and underside of abdomen wholly black (often wholly covered with bluish bloom) or lemon-yellow with a bluish streak on sides and the sutures brown.

Length, 1·66 mm. to 2 mm.; width, ·68 mm. to ·85 mm.

Hab. New Caledonia (type loc.). South Australia: Adelaide, Myponga Swamps, Murray River, Port Willunga, and Northern Flinders Ranges (H. M. Hale); Queensland: Cairns (A. M. Lea); New South Wales: Myall Lakes (A. J. Nicholson), Broken Hill (F. W. Shepherd), Dorrigo; Tasmania: Devonport (A. M. Lea); Lord Howe Island (A. M. Lea); New Zealand: Nelson, etc. (J. G. Myers).

The distribution of the species is interesting. As indicated above, the colouration is considerably variable in a long series of the apterous form; the shape in dorsal view is variable in the female (less markedly so in the male), owing to the different angles assumed by the connexivum.

This species is apparently very closely allied to *M. macgregori* Kirk. [11], but the specimens before me differ from Kirkaldy's description of that species in the relative lengths of the segments of the antennae and legs; in *M. oceanica* the first and second segments of the antennae are not subequal in length and the first tarsal segment is not subequal in length to the second in either the intermediate or posterior legs. Distant describes a single winged specimen, and states that he examined a series of the apterous form; he figures the macropterous example (which appears to be a female) and an apterous female. The colour markings of some of the Australian specimens are as in these illustrations.

M. oceanica is the commoner of the two species occurring in South Australia. As with other members of the family, it is gregarious, and is occasionally found in very considerable number; it commonly inhabits pools with abundant surface vegetation, but also favours the quieter creeks, in which it keeps close to the shore, never venturing far out into the stream. At the Myponga swamps are many permanent pools, closed in by dense scrub, and crowded with a dense growth of *Myriophyllum* in summer. Such pools contain a variety of sub-aquatic bugs, insect larvae, Ostracods, etc., and on the surface of many of them this little species occurs abundantly. The winged form has been taken on water standing in buckets and other receptacles.

M. oceanica, in company with *Mesovelia hungerfordi*, appeared regularly each summer, for some years, upon an artificial pond containing *Potamogeton* and

(11) Kirk., Rev. d'Ent., xviii, 1899, p. 91, and Trans. N. Zeal. Inst., xl, 1907, p. 109.

water-lilies. Green aphids lived upon the leaves of the water-lilies, and, while the sun was shining on the pond, the *Microveliae* were repeatedly seen to spear the "plant-lice". A victim is held at the tip of the beak, with no other support than that of the rostral stylets, the beak being held straight out in front of the head. On one occasion a tiny bug transfixed an aphid fully as large as itself and, at the first attempt to lift the captive, overbalanced and fell on its back on the surface of the lily leaf; the aphid was not released. The *Microvelia* quickly righted itself, and commenced to feed in the usual way.

Bueno describes the toilet preparations of *M. americana:* doubtless all species are of necessity equally cleanly. *M. oceanica* occupies a considerable part of its time in combing the hairs of the body, legs, and antennae.

In mating, the male approaches the female from the rear and, with a sudden little hop, jumps on to her back. Pairs were observed *in copula* in July, with the water at a temperature of 60° F., and in January, on a tiny pool, with the water at 90° F.

MICROVELIA HOWENSE sp. nov.

Apterous ♂. Form narrowly obovate, tapering, widest at prothorax, three times longer than wide. Head brownish-black, dull, with a shining, black median carina, a raised, shining, black spot near intero-lateral angles of eyes, and a few black punctae; with long, pale yellow pubescence alongside inner margins of

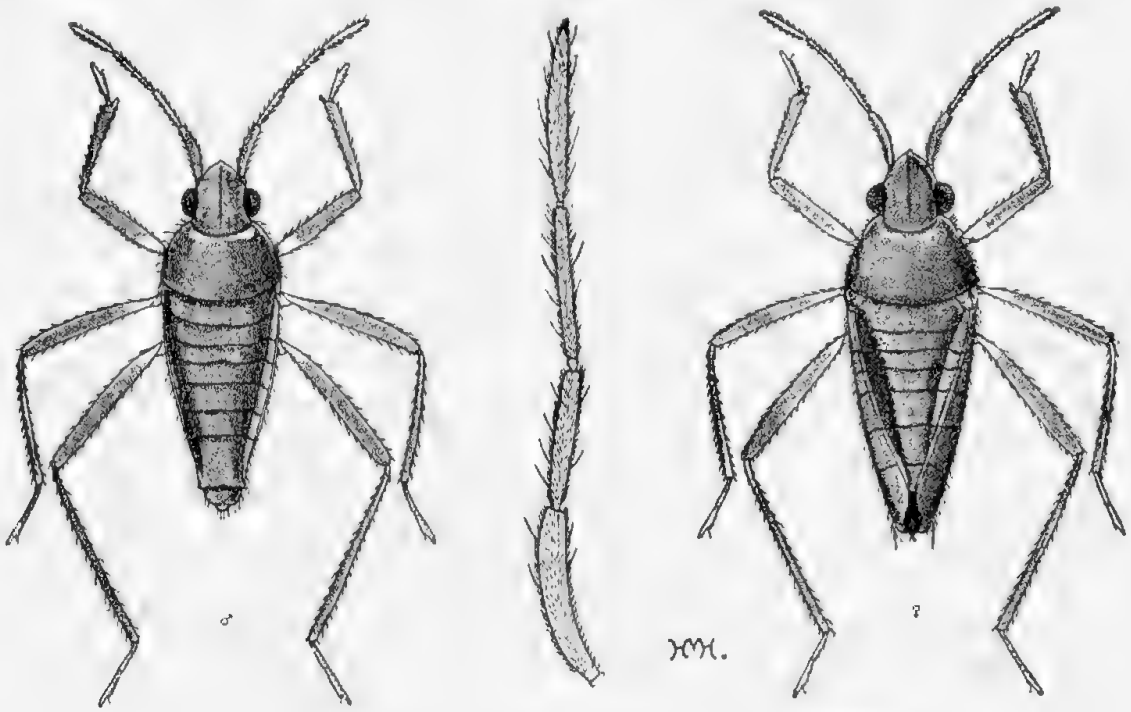

Fig. 86. *Microvelia howense;* apterous male and female.

eyes, and stiff, black hairs towards apex; sparsely pubescent on disc; large and prominent, well produced sub-conically in front of eyes; medial length about equal to width, including eyes. Antennae brown, clothed with dense, pale pubescence intermixed with longer hairs; rather stout, and about as long as abdomen; first segment slightly curved, one-fourth longer than second, a little longer than third (which is the most slender) and equal in length to fourth. Pronotum black, with an almost interrupted, anterior, yellow fascia; surface dull; disc with very sparse and short yellowish pubescence, and some stout, black hairs, which are thickly set laterally; medial length a little more than one-half humeral width; a very obsolete median carina; posterior margin evenly convex and lateral margins slightly sinuate. Dorsum of abdomen black, each segment brownish on centre of disc; surface dull, clothed with pale, yellow pubescence; a patch of shining, silvery pubescence and a few black hairs near posterior angles of metanotum; seventh segment longer than wide, posterior margin emarginate. Genital segments brown, shining, prominent, the first medianly carinate. Connexivum dark ochraceous, clothed with stiff, black hairs; sub-erect. Face yellowish-brown. Rostrum brown, black at apex; reaching to posterior margin of prosternum. Underside brown, in parts black, with pubescence almost absent on disc. Surface of sternum sub-nitid, of abdomen dull. Legs long, with coxae, fulchra, and basal third of femora, ochraceous; remainder brown. Anterior femora a little longer than tibiae, which are more than twice as long as tarsi; tibial comb occupying the anterior half of the length of inner side, and curving over the apex of the produced portion. Intermediate tibiae as long as femora and nearly twice as long as tarsi, the second segment of which is one-third longer than first. Posterior femora reaching almost to apex of abdomen; tibiae more than one-fourth longer than femora and scarcely more than twice as long as tarsi, the second joint of which is about one-third longer than first.

Length, 2·8 mm.; width, ·9 mm.

Apterous ♀. Pubescence on dorsum of abdomen extremely sparse. Connexivum bent inwards over abdomen, sub-erect, converging for greater part of length and almost meeting at middle of sixth segment; on posterior half of this segment the two sides of the connexivum form a cup, from which emanates a bunch of setae.

Length, 3 mm.; width, 1·1 mm.

Hab. Lord Howe Island; Erskine Valley, Mount Gower (A. M. Lea).

A series was taken from fresh water in "rockholes". This and the previous species are scarcely typical representatives of *Microvelia*. The long legs are distinctive; the teeth of the tibial comb are very closely set towards the recurved apical portion; in all, there are about eighty to ninety teeth in the comb.

MICROVELIA MJOBERGI Hale.

Microvelia mjobergi Hale, Arkiv f. Zool., K. Svenska Vet.-Akad., xvii A, 1925, p. 6, fig. 4.

This species is known only from the apterous form. It is allied to *M. peramoena*, but differs in having the antennae longer and more slender, the form

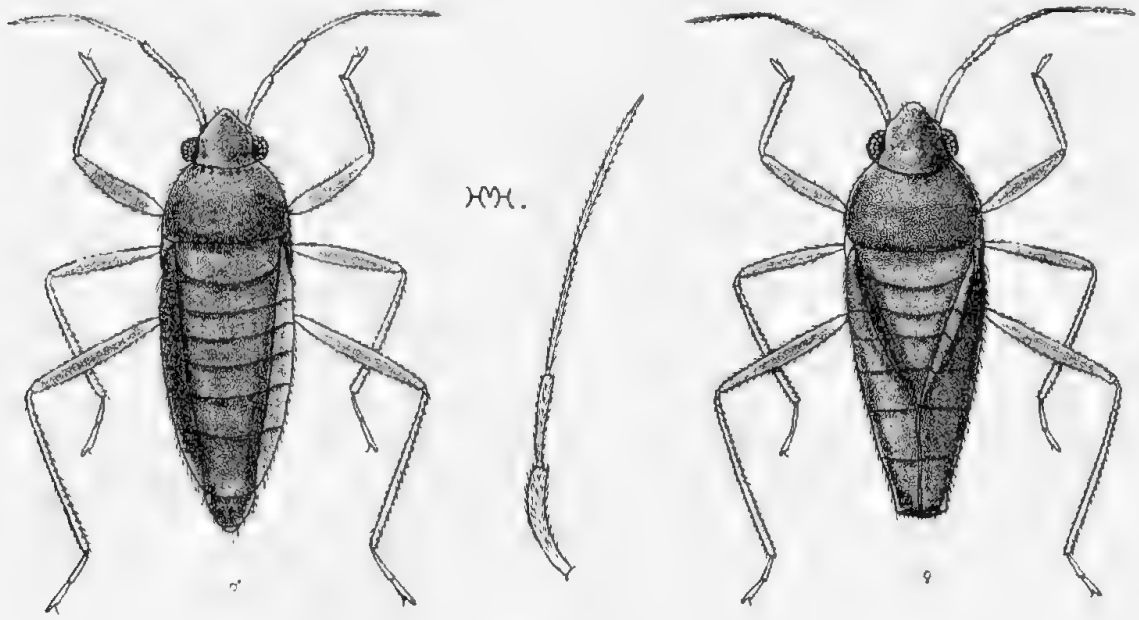

Fig. 87. *Microvelia mjobergi*: apterous male and female.

more elongate, and the legs and antennal segments of slightly different proportions; also, the anterior tibial comb of the male is relatively longer, occupying nearly two-thirds of the length of the inner margin of the tibiae.

Length, 3 mm.; width, 1 mm.

Hab. Queensland: Herberton (type loc.).

MICROVELIA PERAMOENA Hale.

Microvelia peramoena Hale, *loc. cit.*, p. 8, fig. 5.

The following characters separate this from other Australian species:

Form robust; macropterous male less than two and one-half times as long as greatest width; apterous male less than three times longer than broad; females a little stouter. Antennae rather short, little more than one-half the total length of the insect; first segment curved, one-sixth longer than second, a little shorter than third and slightly more than three-fourths as long as fourth. Anterior tibial comb of male occupying about one-half the length of inner margin of tibiae. Posterior femora not nearly reaching to apex of abdomen. Rostrum extending almost to middle of mesosternum.

Macropterous form: Length, 2·35 mm. to 2·55 mm.; width, 1 mm. to 1·3 mm.

Apterous form: Length 2·35 mm. to 2·55 mm.; width, ·96 mm. to 1·15 mm.

Hab. I have examined specimens from various localities in South Australia, Queensland, New South Wales, Victoria, Western Australia, and Tasmania.

This species, and the much smaller and more slender *M. oceanica*, are the only members of the genus so far met with in South Australia. In this State *M. peramoena* occurs commonly in both winged and apterous state, wingless examples being the more plentiful. It is found in greater number on clear, slowly running, weedy streams than in any other situation, but has also been

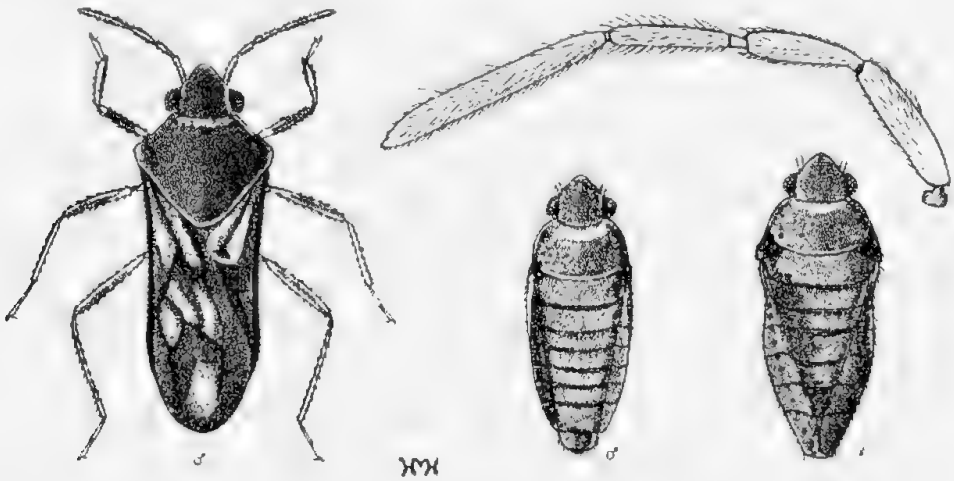

Fig. 88. *Microvelia peramoena*: macropterous male and apterous male and female.

obtained from dams, horse troughs, and other stagnant waters. I have taken both winged and apterous examples from the surface of rainwater retained in smooth pot-holes worn in rocky cliffs near the coast, these temporary pools being destitute of vegetation or shelter of any kind.

During a recent visit to the Northern Flinders Ranges this species was observed on the surface of deep, clear, reed-lined pools at the bottom of the beautiful gully through which the Wilpena Pound is entered. The bugs were congregated in little groups wherever a tiny larva had fallen on to these quiet waters from the tall, overshadowing eucalypts, and were busily engaged in extracting the juices of the caterpillars. As many as nine *Microveliae* were observed feeding at the same time upon a caterpillar only 5 mm. in length.

MICROVELIA DUBIA sp. nov.

♂ Form sub-fusiform, two and three-fourths times longer than wide. Head black, with brownish collum; dull, and clothed with pale pubescence. Antennae brown, with golden pubescence; about as long as abdomen; first segment

a little longer than second and slightly shorter than third or fourth, which are subequal in length. Pronotum sparsely clothed with whitish and black pubescence mixed; nearly five times as wide as medianly long; ochraceous and sub-nitid on disc, black on sides, with posterior margin sinuate; mesonotum black, dull, with hinder margin convex. Dorsal abdominal segments one to six brownish-black, dull, and clothed with sparse, pale pubescence and some stiff black hairs; dorsum of seventh segment brownish-black on anterior two-thirds, ochraceous and sub-nitid posteriorly, clothed with conspicuous black hairs; wider than long. Disc of genital segment ochraceous, shining; sides blackish. Connexivum reddish-

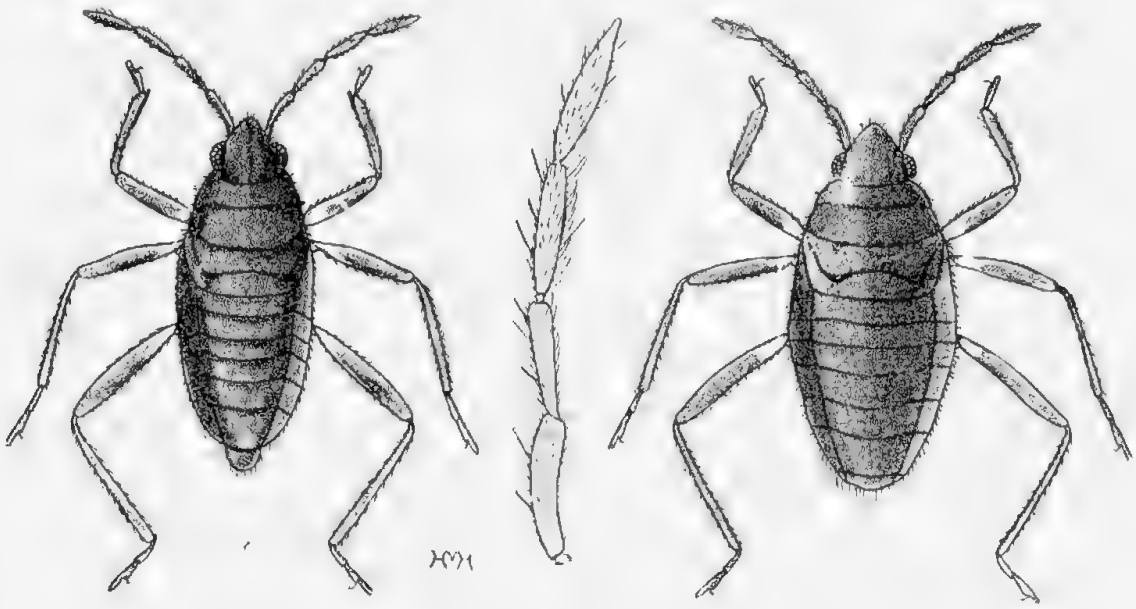

Fig. 89. *Microvelia dubia*; apterous male and female.

brown, with clothing as on dorsum of abdomen; sub-erect. Rostrum ochraceous, with a broad median stripe and whole of terminal segment blackish-brown. Sternum brown, and underside of abdomen dark brown; clothed with very short and sparse, pale pubescence, and with black hairs on sides. Coxae, fulchra, and proximal half of femora ochraceous; remainder of legs dark brown. Anterior femora stout, subequal in length to tibiae, which are about twice as long as tarsi; tibial comb narrow, less than one-third the length of inner margin of tibiae. Intermediate femora subequal in length to tibiae, which are about twice as long as tarsi. Posterior femora a little shorter than tibiae, which are two and one-half times as long as tarsi. Intermediate and posterior tarsi with second segment twice as long as first.

Length, 2·5 mm.; width, ·96 mm.

♀ Form oval, about two and one-third times longer than wide. Seventh dorsal abdominal segment short, posteriorly sub-truncate.

Length, 2·5 mm.; width, 1·1 mm. to 1·25 mm.

Hab. Tasmania: Devonport (type loc.) (A. M. Lea); New South Wales: Mount Kosciusko (A. J. Nicholson).

In females from Mount Kosciusko the tip of the abdomen is bent down and the connexivum is not at all erect, so that the insects are sub-ovate in form. Mr. Nicholson discovered these specimens "skating on the surface of still water amongst the vegetation at the edge of a mountain stream".

Presuming that the specimens described above represent a phase somewhat similar to that stated by Bergroth to occur in some apterous Gerrids, I have referred this species to *Microvelia*. Writing of the thorax of the Gerridae, Bergroth ([12]) remarks, "In the same species it is possible to find two apterous forms, both with well-developed genitalia; one with the pronotum more or less fused with the mesonotum . . . the other with the mesonotum distinctly separated from the pronotum".

MICROVELIA AUSTRALICA Bergroth.

Microvelia australica Berg., Proc. Roy. Soc. Vict., xxix, 1916, p. 38.

This small species is evidently very nearly allied to *M. oceanica* Dist. and *M. macgregori* Kirk. Bergroth states that the second joint of the antennae is "as long as the first" (as in *M. macgregori*), while Distant, in describing the antennae of *M. oceanica*, says, "first joint . . . slightly longer than second". According to the descriptions this seems the only character of importance separating *M. australica* from *M. oceanica*.

MICROVELIA MELANCHOLICA Hale.

Microvelia melancholica Hale, *loc. cit.*, p. 5, fig. 3.

Macropterous ♂. Form slender, nearly three times as long as greatest breadth. Antennae about one-half of total length of insect; first segment curved, a little more than three-fourths as long as second and two-thirds as long as fourth, which is slightly longer than third segment. Anterior tibiae a little shorter than the stout femora and two and one-third times as long as the tarsi, with a comb occupying about one-third of length of inner margin. Intermediate tibiae subequal in length to femora and one-eighth as long again as tarsi, the first segment of which is one-fourth longer than second. Posterior tibiae one-tenth longer than femora and one-half as long again as tarsi, the first segment

([12]) Berg., Ent. Month. Mag., xxxviii, 1902, p. 259.

of which is nearly one-third longer than second. Rostrum reaching nearly to middle of mesosternum.

Length, 2·75 mm. to 2·9 mm.; width, ·95 mm. to 1 mm.

Macropterous ♀. Form stouter and size larger than in male; abdomen swollen.

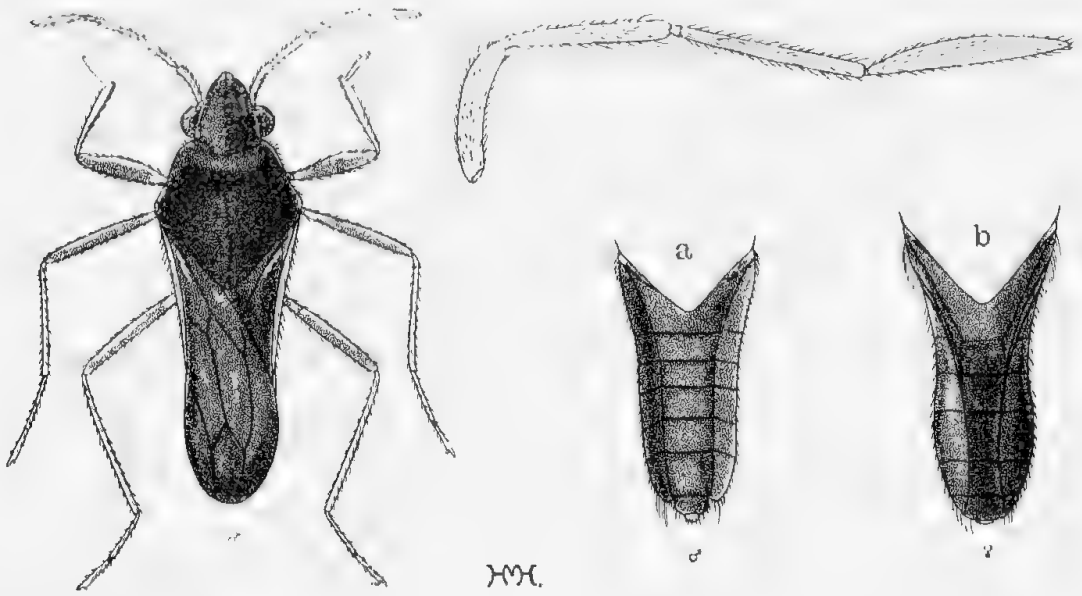

Fig. 90. *Microvelia melancholica*; macropterous male; *a* and *b*, dorsal view of abdomen of male and female.

Length, 3·4 mm. to 3·65 mm.; width, 1·2 mm. to 1·25 mm.

Hab. Queensland: Malanda and Herberton (type loc.).

The illustration shows the differences in the abdomen of the sexes. This distinct species is readily recognized by the dark colouration, slender form, and the proportions of the segments of the legs and antennae. It is known from the winged form only.

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THE TAVAU OR COIL FEATHER CURRENCY OF SANTA CRUZ ISLAND

BY EDGAR R. WAITE, F.L.S., C.M.Z.S., DIRECTOR, SOUTH AUSTRALIAN MUSEUM

Summary

Under the above title, the late Robert Etheridge published a paper, wherein he reviewed the literature of the subject dealt with, and also supplied a lengthy description, so that with one exception apparently little remains to be written.

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Text fig. 91.

Under the above title, the late Robert Etheridge (1) published a paper, wherein he reviewed the literature of the subject dealt with, and also supplied a lengthy description, so that with one exception apparently little remains to be written.

Fig. 91. Tavau, with Triad.

(1) Etheridge, Rec. Aust. Mus., iv, 1902, p. 289, pl. xliv.

The exception referred to is, however, somewhat important, and forms the subject of the present note.

Early this year the South Australian Museum received from Dr. C. Mervyn Deland, of Vanikoro, Santa Cruz Group, a small bird accompanied by the following note: "I am sending you a small Honey-eater, the bird that is used to make 'feather-money' in these islands; they are quite common."

At the time Etheridge's paper was written I also was engaged at the Australian Museum, Sydney, and remembering the article, and the mention therein of lorikeets' feathers, I again referred to it. The point at issue is the statement that the red feathers used are those of "a lorikeet (*Trichoglossus massena* Bonpt.)." It would appear, however, that the feathers were not critically examined, but that the statements of the Rev. Dr. R. H. Codrington (2) were simply accepted and quoted as follows: "*Feather-money* is peculiar to Santa Cruz; it is made of the red feathers from under the wings of a parrot, *Trichoglossus massena* . . . ." Edge Partington (3), whose note is also referred to by Etheridge, probably likewise accepted Codrington's statement, for in describing his figure of tavau in the collection of the Rev. Alfred Penny he wrote: "Native money: made of a band of wood with parrot feathers sewn on to the outer surface."

The statement of Dr. Deland, supported as it was by an actual bird, led us to examine the specimen of tavau preserved in this Museum, and Dr. A. M. Morgan, our Hon. Curator in Ornithology, says that the feathers composing our example are certainly those of a Honey-eater, and quite similar to those of the bird sent, which is probably *Myzomela boiei*.

Just at this time I received a letter from another old colleague, Mr. W. W. Thorpe, now Ethnologist at the Australian Museum, drawing attention to the circumstance that an example of the rare feather-money currency of Santa Cruz had come into his hands for disposal, and suggesting that if our Museum did not possess an example we might embrace the opportunity afforded of acquiring one. With the previously mentioned information before me, I wrote to Mr. Thorpe, and asked him to be good enough to examine the specimen originally described by Etheridge, and also that now offered, in order to ascertain the bird of origin of the red feathers used. His reply embodied the following: "Mr. Kinghorn (ornithologist) identifies the feathers in *both* examples as of *Myzomela*, but is uncertain whether to ascribe them to *M. boiei* or *M. pulcherrima*; at all events they *are not* the *Trichoglossus*."

When previously writing to Dr. Deland, and presuming that the feathers of

(2) Codrington, The Melanesians, 1891, p. 324.

(3) Partington, An Album of Weapons, etc., i, 1890, pl. 165.

the tavau in the Australian Museum were those of *Trichoglossus*, as stated, I suggested to him that it would be interesting to learn if feathers of both the Parakeet and Honey-eater were utilized in making tavau, or if, say, the former had become scarce, and that the feathers of the Honey-eater were now being substituted, or *vice versa*. I had inclined to the former *Trichoglossus*, later *Myzomela*, view because in his letter Mr. Thorpe states that "the coil under offer is probably the last obtainable, as it was reluctantly made to discharge a debt by an old native, the last feather-worker on Vanikoro," who would naturally use the feathers then obtainable. Seeing that all the three tavaus that have been critically examined with a view to ascertaining the source of the component feathers, show that those of *Myzomela* were used, it will be interesting if Museums or individuals possessing examples will similarly publish the results of examination.

The late Sir Edward Stirling, my predecessor in the directorate of this Museum, was aware with what feathers the tavau in the South Australian Museum is decorated, as shown by his label thereon, which reads: "Coil of Feather Money, made of pigeons' feathers and the red breast feathers of a Honey-eater fixed to a foundation of vegetable fibre similar to that used for making the Santa Cruz fishing lines. The birds providing the red feathers are caught alive, plucked, and released." This information was supplied by the then Bishop of Melanesia, the Rt. Rev. Cecil Wilson, who also donated the example of tavau to the Museum.

On writing to His Lordship, now Bishop of Bunbury, Western Australia, for further details about the tavau, he very kindly sent me the following information: "A coil of the Santa Cruz feather-money, which has largely lost the red feathers, corresponds to our copper coins. A new red coil is to Cruzians what gold is to us. I once offered £2 for a new red coil, but the man refused it. Later I found that a small Berkshire pig would buy one, and I imported one for the purpose.

"A man buys a wife with one or two red coils and perhaps fifty worn ones. At a dance, coils of money are hung on the coral slabs that surround the dancing ground by the man who gives the dance. I saw a man on his deathbed, with his money hanging on the walls of the house; probably it had been divided for legacy purposes.

"This feather-money is made by the men; on a wooden spatula, about the width of a coil, pigeon feathers are glued together and tipped with red. When a sufficient number of these layers have been made, they are bound together with string in such a way that only the red tips of the layers show.

"On the card you sent me" (*vide* note on label above), "it is stated that the foundation is vegetable fibre: I think this is wrong, for, as far as I remember,

the only foundation is the pigeons' feathers. Is the 'triad' of which you write the same as what I have called a spatula? The latter was not triangular, but more a square with a handle."

In response to my further letter, His Lordship supplied the following additional information, which has probably not been previously published:

"I understand now what the 'triad' is, but I do not remember ever having seen one, but this must be because these coils of money are more stored than current. They are brought out on great occasions. A rich man keeps his money over the fire in the middle of his house to keep it dry. On one occasion, when a fire destroyed a village, every man left his own house to be burnt, in order that he might save the chief's house, where there was a vast store of this money.

"The coils are unwound, and the money is hung vertically on the walls round the body of the sick or dead man. Red is the colour of importance: at the nose-boring of infants, and at nostril-boring a little later, at marriage, and at death. A Cruzian is painted red when he dies, and he lies with all his ornaments, nose ring, earrings, etc., a red body with red money all round it."

Etheridge concludes his paper by remarking that this feather currency appears to be comparatively rare in collections, and he cites knowledge of the depositories of three examples only. The "money" has been twice figured, first by Edge Partington, whose pen sketch shows it partly uncoiled and as dissociated from the "three-armed piece of wood (cut out of the solid) invariably found with the 'parcel' of feather-money." The second illustration is a photographic reproduction by Etheridge; in this picture the tavau is also partly uncoiled, and it shows the various accessories described in the text, but lacks the three-armed piece of wood. Under these circumstances a third figure may not be out of place, and the illustration now supplied is from the specimen referred to by Mr. Thorpe, whom I have to thank for kind permission to reproduce the photograph he sent to me. In this picture the tavau is fully coiled; there are no accessories, such as Jobs' tears *(Coix lachryma)*, nautilus or mussel shells, but the three-armed piece of wood is present, also a long length of sinnet, which, after passing through a hole in the meeting place of the three arms, is secured by a knot. This is not shown in Partington's illustration, and indication of the hole, if present, was omitted. It will be noticed that in both illustrations of the triad it is not a tri-symmetrical, but a Y-shaped object.

SUPPLEMENT TO THE CATALOGUE OF THE FISHES OF SOUTH AUSTRALIA

BY EDGAR R. WAITE, F.L.S., C.M.Z.S., DIRECTOR, SOUTH AUSTRALIAN MUSEUM

Summary

Having been asked to supply a check-list of the marine fishes of South Australia for publication in the Journal of the Pan-Pacific Research Institution, it seems advisable to first record here information published since the issue of the Catalogue. Matter contained in one paper, dated eleven days in advance of the date of publication of the Catalogue, could not be recorded therein, and is therefore entered here.

SUPPLEMENT
TO THE CATALOGUE OF THE FISHES OF SOUTH AUSTRALIA

By EDGAR R. WAITE, F.L.S., C.M.Z.S., Director, South Australian Museum.

Plate xiii.

Having been asked to supply a check-list of the marine fishes of South Australia for publication in the Journal of the Pan-Pacific Research Institution, it seems advisable to first record here information published since the issue of the Catalogue (1). Matter contained in one paper, dated eleven days in advance of the date of publication of the Catalogue, could not be recorded therein, and is therefore entered here.

The supplementary notes are, for the most part, recorded under the following titles in the publications indicated, and the letter appended to each entry refers to the paper bearing such letter. The inclusion of supplementary notes in the Handbook (2) which was based on the Catalogue is indicated by the letter "G."

The numbers prefixed to each entry show the approximate position of the species in relation to those in the Catalogue, as determined by the figures beneath the illustrations. The letters *a*, *b*, or *c* following a number indicate family relationship to the species bearing such number; the letters *x*, *y*, or *z*, on the other hand, merely indicate the approximate position of the species in the list, without implying close relationship.

A. 1921, McCulloch, Studies in Australian Fishes. Rec. Aust. Mus., xiii, p. 123.

B. 1921, McCulloch, Notes on and Descriptions of Australian Fishes. P.L.S., N.S.W., xlvi, p. 457.

C. 1922, Waite, Description of a New Australian Fish of the genus *Congiopus*. Rec. S.A. Mus., ii, p. 215.

D. 1922, Waite, Studies in Australian Sharks. Rec. S.A. Mus., ii, p. 219.

E. 1922, McCulloch, Check-list of the Fishes of New South Wales. Australian Zoological Handbook No. 1 (originally issued in 3 parts).

F. 1923, Waite, Fishes of Nuyts Archipelago. Trans. Roy. Soc. S.A., xlvii, p. 95.

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(1) Waite, Rec. S. Aust. Mus., ii, 1921, p. 1-208, pl. i, text fig. 1-332.

(2) Waite, Handbook to the Fishes of South Australia, 1923, p. 1-243.

G. 1923, Waite, Handbook to the Fishes of South Australia. (See footnote [2].)

H. 1924, Waite, Illustrations of and Notes on some Australian Fishes. Rec. S.A. Mus., ii, p. 479.

I. 1926, McCulloch, Biological Results. F.I.S. "Endeavour," v, p. 157.

J. 1926, Norman, Biological Results. F.I.S. "Endeavour," v, p. 219.

K. 1926, Norman, Proc. Zool. Soc., p. 941.

As an early mentor, in Ichthyology, of the late Allan Riverstone McCulloch, I take this opportunity of briefly expressing my grief at his early demise and of adding my testimony to the excellence of his work on Australian Fishes with both pen and brush. Dr. Charles Anderson, Director of the Australian Museum, Sydney, has published an obituary notice with portrait and bibliography ([3]).

Corrections and Additions.

8. CARCHARHINUS MACRURUS Ramsay & Ogilby.

Carcharias macrurus Rams. & Ogil., P.L.S., N.S.W. (2), ii, 1887, p. 163.

According to McCulloch the species represented by the names *C. brachyurus* and *C. macrurus* are not identical, and that the South Australian representative should be designated as above; he also prefers the corrected spelling of the genus to the original form *Carcharinus* (B).

13. MUSTELUS ANTARCTICUS Günther.

The figure is imperfect, lacking the anal fin; an illustration by McCulloch is substituted (G).

19. PARASCYLLUM FERRUGINEUM McCulloch.

A young example, 168 mm. in length, is described and figured (D).

20. HALAELURUS VINCENTI Zietz.

Regarded as congeneric with *H. analis* Ogil. (G).

APTYCHOTREMA Norman, 1926 (bougainvillii).

38. APTYCHOTREMA BANKSII Müller & Henle.

Rhinobatus banksii Müll. & Henle, Plagiost., 1838, p. 123, 192.
Aptychotrema banksii Norman, Proc. Zool. Soc., 1926, p. 978, fig. 30.

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(3) Anderson, Rec. Aust. Mus., xv, 1926, p. 141, with 2 plates.

Norman suggests that *R. philippi* is a synonym of *R. granulatus* Cuvier, from India and China; both Australian members being referable to the new genus, hence *Aptychotrema bougainvillii* and *A. banksii*, the latter only recognized from South Australia (K).

42. RAJA AUSTRALIS Macleay.

Raia australis Macl., P.L.S., N.S.W., viii, 1884, p. 461.

The Tasmanian *R. temprieri* differs from the Australian form, which was named as above (G).

44. DASYATIS BREVICAUDATUS Hutton.

The illustration was from a New Zealand example; that substituted is by McCulloch, from an Australian specimen (G).

NEMATALOSA Regan, 1916 (nasus).

54. NEMATALOSA RICHARDSONI Castelnau.

Plate xiii.

Chatoessus richardsoni Cast., P.Z.S., Vict., ii, 1873, p. 144; Ogil. Edib. Fish. N.S.W., 1893, p. 178.

It becomes evident that the Australian species of *Nematalosa* require to be critically examined, with a view to determining the synonomy. According to McCulloch (E), *N. come* and *N. erebi* are distinct species, the former being marine and the latter of fresh water habit. Five names have been bestowed, as follows: *Chatoessus come* Richardson, 1846, Western Australia; *C. erebi* Günther, 1868, Queensland and New South Wales; *C. richardsoni* Castelnau, 1873, Murray River; *C. elongatus* Macleay, 1883, Mary River, Queensland; and *C. horni* Zietz, 1896, Central Australia. The case is further stated by Mr. Gilbert P. Whitley, of the Australian Museum, Sydney, who in a recent letter writes: "The name *Nematalosa come* may evidently be restricted to the Western Australian form. *Chatoessus erebi* may perhaps be regarded as a substitute name for *C. come* Richardson (not *kome* Russell), in which case it would become a direct synonym of it, or, as generally accepted, *C. erebi* may be considered a distinct species described from Eastern Australia, with Richardson's species apparently erroneously included as a synonym." Mr. Whitley says he prefers the latter interpretation, as Günther made no reference to Richardson's type in his catalogue. He adds: "*Nematalosa richardsoni* Cast. seems to me to be distinct from *N. erebi*, as one might expect from the distance apart of the type localities. Günther says

of *C. erebi*, 'Origin of the dorsal fin . . . . behind the base of the ventrals,' whilst in Castelnau's *C. richardsoni* the ventrals are placed a little behind the vertical from the insertion of the dorsal''; and further: ''The New South Wales species, called *Nematalosa come* in McCulloch's Check-list (p. 17), may be distinct from *N. come* Richardson; if it is not *N. nasus* Bloch it evidently requires a new name.'' Mr. Whitley says that, not having a representative series of specimens, his remarks are largely based upon a review of the literature.

Ogilby *(vide supra)* has furnished a careful description of a Murray River specimen, and this will suffice; attention may, however, be drawn to an apparent discrepancy: he writes: ''Nostrils approximate, pierced in a lateral groove midway between the tip of the snout and the orbit; the anterior small, elliptical, and vertical; the posterior large and subcircular.'' In our examples from near the mouth of the River Murray the anterior nostril is nearly circular, the posterior one a long, vertical slit.

Under *N. erebi* Günth. McCulloch placed *Chatoessus horni* Zietz as a probable synonym, remarking that it is apparently merely a slender variety of that species.

Apart from the outline figure of *C. horni*, supplied by Zietz, and which species may not be conspecific with *N. richardsoni*, no illustration of the latter species has hitherto been published; the accompanying picture is from a Murray River specimen, taken in this State. Length, 320 mm. The Bony Bream attains to over 400 mm.

Castelnau ([4]), Klunzinger ([5]), and Ogilby *(loc. cit.)* all refer to a paper by W. Blandowsky ([6]), from which, however, four pages, containing two plates, were deleted. Mr. Whitley, who has seen the original plate, says that *C. richardsoni* is depicted there as fig. 2 on plate lxx; he has furnished me with some interesting notices of the paper, but as he announces his intention of supplying bibliographical accounts of several obscure writers on Australian Natural History, more cannot here be written. I may, however, reprint Castelnau's explanation of the withdrawal of the pages from Blandowsky's paper: ''A rather curious anecdote is told me of this production. The author had, according to the custom of naturalists, dedicated several of the sorts to leading members of the Society; but some of these gentlemen are said to have taken as an insult what was probably intended as a compliment, and the letterpress and plates already engraved were withdrawn and destroyed before distribution. I must own that I cannot say much for the scientific value of the paper, but I have found in it

(4) Castelnau, P.Z.S. Vict., i, 1872, p. 31.

(5) Klunzinger, Sitzb. Akad. Wiss. Wien, lxxx, 1879, p. 327.

(6) Blandowsky, Trans. Phil. Inst. Vict., ii, 1857 (1858), p. 124-137, *sans* p. 131-134 incl.

a few observation on the habits of several sorts of the interior rivers." Nine papers by Blandowsky, of which that here noticed is the sixth, are recorded in the "Royal Society Catalogue of Scientific papers," 1800-1863, i, p. 417.

FAMILY ALEPOCEPHALIDAE.

ALEPOSOMUS Gill, 1884 (copei).

56x. **ALEPOSOMUS SQUAMILATERUS Alcock.**

Xenodermichthys squamilaterus Alcock, Ann. Mag. Nat. Hist. (7), ii, 1898, p. 148.

Aleposomus, Roulcina, squamilaterus McCull., Endeavour Res., v, 1926, p. 163, pl. xliv, fig. 1 (syn.).

The first known Australian examples were taken by the "Endeavour" in 350 to 450 fathoms in the Australian Bight, south of Eucla (I).

DIAPHUS Eigenmann & Eigenmann, 1891 (eugraulis).

66a. **DIAPHUS COERULEUS Klunzinger.**

Scopelus coeruleus Klunz. Verh. K. Zool. Bot. Ges. Wien, xxi, 1871, p. 152.

Diaphus coeruleus (Gilbert) McCull., Endeavour Res., v., 1926, p. 160, pl. xliii, fig. 1, 2 (syn.).

The specimens recorded were taken in the Australian Bight, south and south-east from Eucla, at depths ranging from 200 to 450 fathoms (I).

FAMILY GONOSTOMIDAE.

POLYMETME McCulloch, 1926 (illustris).

66x. **POLYMETME ILLUSTRIS McCulloch.**

Polymetme illustris McCull., Endeavour Res., v, 1926, p. 167, pl. xlv., fig. 1.

Specimens were taken in the Australian Bight in 200 to 450 fathoms, also off Gabo Island Victoria (I).

ARGYRIPNUS Gilbert & Cramer, 1897 (ephippiatus).

66y. **ARGYRIPNUS IRIDESCENS McCulloch.**

Argyripnus iridescens McCull., Endeavour Res., v, 1926, p. 169, pl. xlv, fig. 2.

Taken in the Australian Bight in 200 to 450 fathoms (I).

ORDER LYOPOMI.

FAMILY HALOSAURIDAE.

HALOSAURUS Johnson, 1863 (oweni).

66z. **HALOSAURUS PECTORALIS McCulloch.**

Halosaurus pectoralis McCull., Endeavour Res., v, 1926, p. 171, pl. xliii, fig. 3.

Two specimens taken in the Australian Bight, south from Eucla, in 350 to 450 fathoms (I).

67-69. For FAMILY SILURIDAE read PLOTOSIDAE (G).

73. **ANGUILLA REINHARDTII Steindachner.**

A new figure is published in the Handbook (G).

75. **MURAENICHTHYS BREVICEPS Günther.**

No complete figure being available, an example, 545 mm. in length, was photographically illustrated in the Handbook (G).

76-95. ORDER SOLENICHTHYES

In 1902 Boulenger (7) proposed the name Solenichthyes as a division of the Catosteomi to include only the family Lampridiidae, which he regarded as being sub-ordinal with the Hemibranchii (sticklebacks, flute mouths, bellows fishes, etc.), Lophobranchii (pipe fishes and sea horses), and Hypostomides (Pegasidae, sea moths). Later Regan (8) used the very similar name Solenichthyes (for the Centriscoids, but afterwards added the Aulostomoids and Lophobranchii) to designate an order embracing some of the families of Boulenger's Hemibranchii and Lophobranchii.

This inter-relationship under two such similar names is confusing, and a statement from Mr. Regan, more clearly defining the position, would be welcomed by systematists.

PHYCODURUS Gill, 1896 (eques).

90. **PHYCODURUS EQUES Günther.**

The illustration of this remarkable fish is from a photograph taken by my colleague, Mr. H. M. Hale (G).

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(7) Boulenger, Ann. Mag. Nat. Hist. (7), x, 1902, p. 147.

(8) Regan, Ann. Mag. Nat. Hist. (8), iii, 1909, p. 84.

LEPIDORHYNCHUS Bleeker, 1879 (villosus).

100. **LEPIDORHYNCHUS DENTICULATUS Richardson.**

The generic name *Lepidorhynchus* has precedence over *Optonurus*. In his paper Mr. McCulloch inadvertently credits the generic name to Richardson (I).

COELORHYNCHUS Giorna, 1805 (laville).

100a. **COELORHYNCHUS FASCIATUS Günther.**

Macrurus fasciatus Günth., Ann. Mag. Nat. Hist. (5), ii, 1878, p. 24.
Coelorhynchus Paramacrurus fasciatus McCull., Endeavour Res., v, 1926, p. 177.

Not uncommon off the eastern slope of Bass Strait; taken in the Australian Bight in 190 to 450 fathoms (I).

MALACOCEPHALUS Günther, 1862 (laevis).

100b. **MALACOCEPHALUS LAEVIS Lowe.**

Macrurus laevis Lowe, P.Z.S., 1843, p. 92.
Malacocephalus laevis McCull., Endeavour Res., v, 1926, p. 181, pl. xlvii.

Taken in the Australian Bight in 350 to 450 fathoms (I).

LIONURUS Günther, 1887 (filicauda).

100c. **LIONURUS NIGROMACULATUS McCulloch.**

Lionurus nigromaculatus McCull., Endeavour Res., v, 1926, p. 182.
Macrourus nigromaculatus McCull., Rec. Aust. Mus., vi, 1907, p. 346, pl. lxiii, fig. 1.

Also known off New South Wales and Victoria; the "Endeavour" trawled examples in the Australian Bight in 350 to 450 fathoms (I).

103. **PHYSICULUS BACHUS Forster.**

A substituted figure, showing the characteristic black spot at the upper base of the pectoral fin (G).

EUCLICHTHYS McCulloch, 1926 (polynemus).

103a. **EUCLICHTHYS POLYNEMUS McCulloch.**

Euclichthys polynemus McCull., Endeavour Res., v, 1926, p. 174, pl. xliv, fig. 2.

Numerous specimens taken in the Australian Bight in 190 to 450 fathoms (I).

120a. **ATHERINA MICROSTOMA Günther.**

Atherina microstoma Günth., Cat. Fish. Brit. Mus., iii, 1861, p. 401.

The figure in the Handbook is after McCulloch (G).

125. **MUGIL CEPHALUS Linnaeus.**

Mugil cephalus Linn., Syst. Nat., ed. x, 1758, p. 316.

Mugil dobula Günth, 1861, is regarded as a synonym of *M. cephalus* (G).

APOGONOPS Ogilby, 1896 (anomalus).

150a. **APOGONOPS ANOMALUS Ogilby.**

Apogonops anomalus Ogil., P.L.S., N.S.W., xxi, 1896, p. 24.

Specimens collected at Kangaroo Island in 1926 constitute a new record for South Australia.

TEMNODON Cuvier, 1817 (heptacanthus).

159. **TEMNODON SALTATOR Linnaeus.**

In the "Genera of Fishes" Dr. David Starr Jordan ([9]) gives reasons for replacing *Pomatomus* with *Temnodon* (G).

Many of the nomenclatorial changes here made are the result of consulting this most useful work and its supplement ([10]).

171. **SCORPIS GEORGIANUS Cuvier & Valenciennes.**

Our form, which is frequently banded, is referable to the type species from King George's Sound, Western Australia (G).

172. Delete in favour of 171 (G).

MELAMBAPHES Günther, 1863 (nigroris).

175. **MELAMBAPHES ZEBRA Richardson.**

This species is not congeneric with *Crenidens tephracops* Rich. (G).

177. **CHELMONOPS TRUNCATUS Kner.**

The figure supplied is from the original illustration of Kner (G).

FAMILY APLODACTYLIDAE.

DACTYLOSARGUS Gill, 1862 (arctidens).

185a. **DACTYLOSARGUS ARCTIDENS Richardson.**

Aplodactylus arctidens Rich., P.Z.S., 1839, p. 96.

An addition to the known fauna of South Australia; a specimen described and figured (H).

([9]) Jordan, "Genera of Fishes," i (with Evermann), 1917; ii (1919); iii (1919); iv (1920).

([10]) Jordan, "Classification of Fishes" (1923).

189. **THREPTERIUS MACULOSUS Richardson.**

Refigured from a specimen collected at Pearson Island (F, G).

206. **ODAX SEMIFASCIATUS Cuvier & Valenciennes.**

Odax semifasciatus Cuv. & Val., Hist. Nat. Poiss., xiv, 1839, p. 299, pl. cccevii.

O. richardsonii Günth. is a synonym (G).

SCARUS Forskal, 1775 (psittacus).

212. **SCARUS MODESTUS Castelnau** (G).

Dr. Jordan says, "*Scarus* of Forskal must give way to *Callyodon* of Gronow if the names of Gronow are to be adopted. This is unfortunate, as *Callyodon* has been used by most authors as the name of another genus in the same family."

213. **SCARUS DUMERILII Castelnau.**

See note above, No. 212 (G).

PARAPERCIS Bleeker, 1863 (cylindrica).

The below-mentioned species are apparently congeneric with *P. cylindrica*. Being preoccupied, the name *Parapercis* Steindachner was replaced by *Neopercis* Steind., of which *P. ramsayi* is the type.

216. **PARAPERCIS RAMSAYI Steindachner** (G).

217. **PARAPERCIS HAACKEI Steindachner** (G).

218. **PARAPERCIS ALLPORTI Günther** (G).

221. **PSEUDAPHRITIS URVILLII Cuvier & Valenciennes.**

Refigured from a Tasmanian example (H).

223a. **CALLIONYMUS APRICUS McCulloch.**

Callionymus apricus McCull., Endeavour Res., v, 1926, p. 209, pl. liv, fig. 2.

Described from a single specimen taken in the Australian Bight in 350 to 450 fathoms (I).

225. **SCOMBER COLIAS Gmelin.**

Delete the note under the figure ("Corrections" and G).

228. **GOBIUS BIFRENATUS Kner.**

A different figure, after Kner, is supplied (G).

232. **GOBIUS FILAMENTOSUS Castelnau.**

Believed to be a synonym of No. 228, *G. bifrenatus* (G).

CALLOGOBIUS Bleeker, 1874 (hasseltii).

234. **CALLOGOBIUS HASSELTII Bleeker,** var. **MUCOSUS Günther.**

See note under "Corrections" and G.

239. **NEOBLENNIUS FASCIATUS Castelnau.**

This fish is so contradictorily defined that it is eliminated (G).

245a. **OPHICLINUS AETHIOPS McCulloch & Waite.**

Ophiclinus aethiops McCull. & Waite, Rec. S.A. Mus., i, 1918, p. 57, fig. 29.

Specimens of this and the following species have been taken at Kangaroo Island, and constitute additions to the fauna of South Australia (G).

245b. **OPHICLINUS VARIUS McCulloch & Waite.**

Ophiclinus varius McCull. & Waite, Rec. S.A. Mus., i, 1918, p. 57, fig. 30.

See note under foregoing species (G).

253-255. SUB-ORDER OPHIDIOIDEA.

This heading, to embrace the Families Brotulidae and Ophidiidae, was inadvertently omitted from the Catalogue (G).

ARNOGLOSSUS Bleeker, 1862 (arnoglossus).

256a. **ARNOGLOSSUS MUELLERI Klunzinger.**

Pseudorhombus muelleri Klunz., Arch. fur Naturg., 1872, p. 40.

Arnoglossus muelleri Norm., Endeavour Res., v, 1926, p. 245 (syn.).

An addition to the known fauna of the State. Specimens were taken in the "Endeavour" off St. Francis Island in 35 fathoms (J).

256b. **ARNOGLOSSUS BASSENSIS Norman.**

Arnoglossus bassensis Norm., Endeavour Res., v, 1926, p. 246, fig. 6.

A young example taken in Investigator Strait; if of this species, it constitutes a new record for South Australia (J).

257. **RHOMBOSOLEA PLEBEIA Richardson.**

Delete from the South Australian list (G).

258. **RHOMBOSOLEA TAPIRINA Hutton.**

Rhombosolea tapirina (part) Günth., Cat. Fish. Brit. Mus., iv, 1862, p. 459; and Norm., Endeavour Res., v, 1926, p. 284.

In the paper quoted Mr. Norman has published the results of investigations on the Flatfishes of Australia and straightened out the intricate synonomy of the group. *P. victoriae* Cast. is believed to be a synonym of *R. tapirina* (J).

261a. **AMMOTRETIS BREVIPINNIS Norman.**

Ammotretis brevipinnis Norm., Endeavour Res., v, 1926, p. 268, fig. 11.

A new species, described from a single small specimen taken in St. Vincent Gulf (J).

AZYGOPUS Norman, 1926 (pinnifasciatus).

261b. **AZYGOPUS PINNIFASCIATUS Norman.**

Azygopus pinnifasciatus Norm., Endeavour Res., v, 1926, p. 262, fig. 10.

South Australian examples of this new species were trawled in from 100 to 450 fathoms in the Australian Bight. It was also taken off Gabo Island, Victoria (J).

FAMILY CYNOGLOSSIDAE.

CYNOGLOSSUS Hamilton-Buchanan, 1822 (lingua).

262x. **CYNOGLOSSUS BROADHURSTI Waite.**

Cynoglossus broadhursti Waite, Rec. Aust. Mus., vi, 1905, p. 73, pl. viii, fig. 2.

Two specimens taken off the mouth of the River Murray bring this species, first described from Western Australia, into the South Australian list (J).

279. **CONGIOPUS LEUCOPOECILUS Richardson.**

The tail in the figure of this species is obviously incomplete, and probably approximates to that of *C. leucometopon*.

279a. **CONGIOPUS LEUCOMETOPON Waite.**

Congiopus leucometopon Waite, Rec. S.A. Mus., ii, 1922, p. 216, fig. 333.

Known only from two beach-driven specimens taken at Glenelg, South Australia (G).

280. **GNATHANACANTHUS GOETZEEI Bleeker.**

A new figure and description are supplied (H).

285. **PLATYCEPHALUS HAACKEI Steindachner.**

It is suggested that No. 286—*P. semermis* De Vis—is identical with Steindachner's species (G).

291. **PARATRIGLA VANESSA** Richardson.

This species is removed from the genus *Lepidotrigla* on account of its spinigerous lateral line (G).

292. **PARATRIGLA PAPILIO** Cuvier & Valenciennes.

Trigla papilio Cuv. & Val., Hist. Nat. Poiss., iv, 1829, p. 80, pl. lxxiii.

McCulloch said that he was unable to find characters to distinguish *T. pleuracanthica* and *T. papilio* (E and G).

307. **CANTHERINES BROWNII** Richardson.

The figure under this name to be transferred to No. 310, *C. guntheri* Macl. (G).

310. **CANTHERINES GUNTHERI** Macleay.

The figure under No. 307 is of this species, McCoy's identification being incorrect (G).

SPHEROIDES Lacepède, 1798 (tuberculatus).

325. **SPHEROIDES TETRAGONUS** Forster.

The genus *Spheroides* differs from *Tetraodon* in having the nasal tentacles perforate (G).

326. **SPHEROIDES PLEUROGRAMMA** Regan.

Tetrodon pleurogramma Regan, P.Z.S., 1902, p. 300, pl. xxiv, fig. 2.

Delete *Tetraodon richei* and illustration, and substitute the above, of which *S. lacrimosus Waite* is a synonym. Illustrations of *S. pleurogramma* have been published by both Regan and Waite (H).

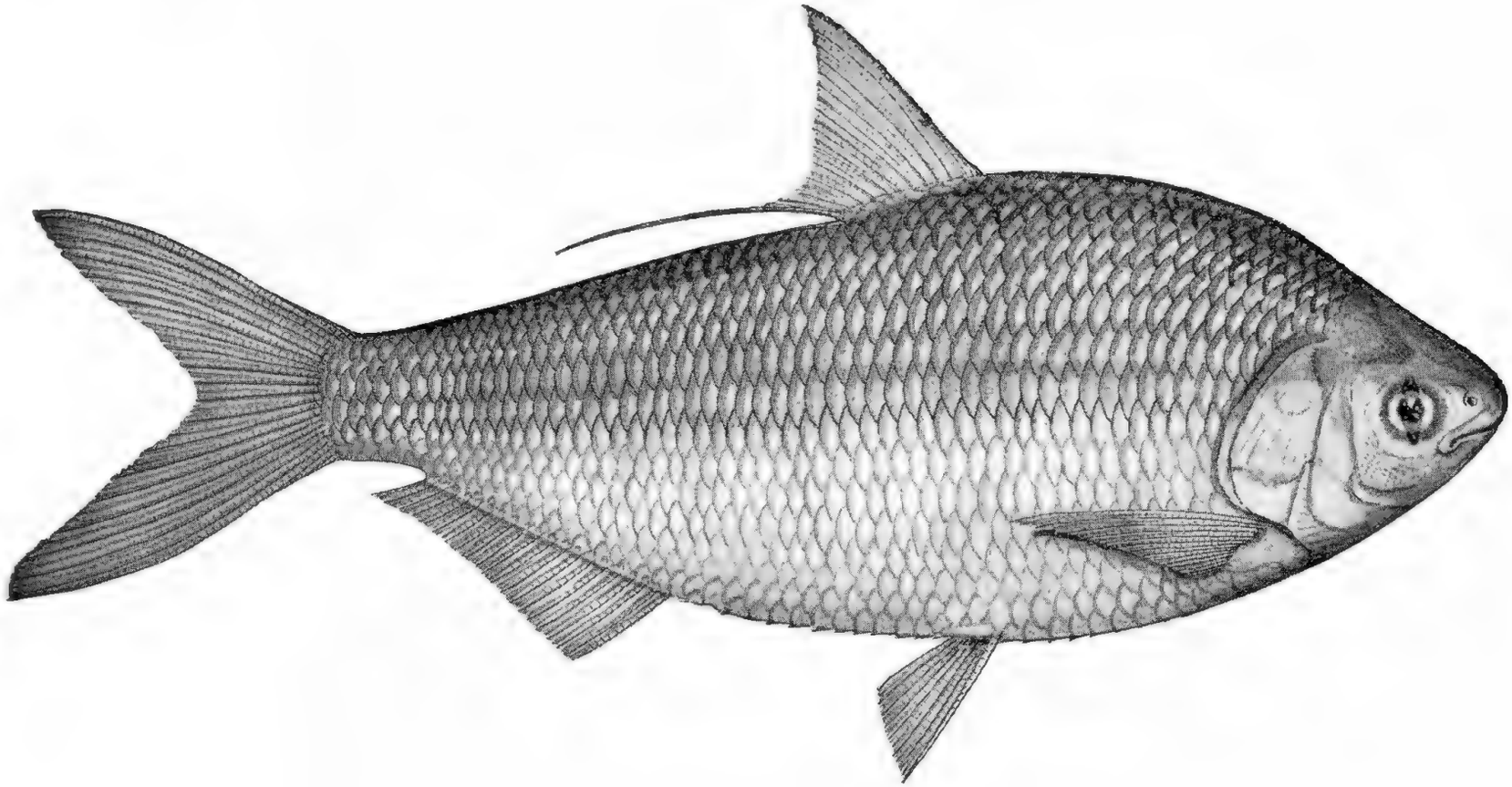
327. **SPHEROIDES LIOSOMUS** Regan.

See note under No. 325 (G).

ALLOMYCTERUS McCulloch, 1921 (jaculiferus).

330. **ALLOMYCTERUS JACULIFERUS** Cuvier.

The genus differs from others of the Family in having all the spines fixed and three-rooted. McCulloch's figure is reproduced in the Handbook (G).



EDGAR R. WAITE, *del.*

NEMATALOSA RICHARDSONI

AUSTRALIAN OPOSSUM SHRIMPS (MYSIDACEA)

BY W. M. TATTERSALL, D.SC., PROFESSOR OF ZOOLOGY, UNIVERSITY COLLEGE, CARDIFF

Summary

In response to my request for Australian material belonging to this group of Crustacea, Mr. Edgar R. Waite, Director of the South Australian Museum at Adelaide, was good enough to submit to me for examination the small collection available in that Museum. Mr. Herbert M. Hale has kindly kept a special look out for specimens, and has forwarded from time to time additional material for examination. To both these gentlemen I am very much indebted for the trouble they have taken to obtain Mysids for me. As a result of their efforts I am able to record here ten species of the group from South Australian waters, of which no fewer than seven species are new to science.

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Text figs. 95-105.

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I have included in this report records of specimens kindly given to me by the late Professor S. J. Johnston, of the University of Sydney, in 1914, and material collected by myself in Tasmania in the same year.

Practically no attention has been paid to the Mysidacea of Australia. No species are recorded in Haswell's catalogue. The Challenger Expedition collected three species in Port Phillip, all new to science, described by Sars under the following names, *Pseudomma australe*, *Anchialus angustus*, and *Mysidopsis incisa*. The only subsequent record of any species from Australia is by Zimmer (8), who described *Anisomysis australis* from Port Phillip. *Siriella thompsonii* (M. Edw.) has been recorded from Australian waters both by Sars (5) and Colosi (2), but as this is a widely distributed, truly oceanic species it can hardly be regarded as properly belonging to the Australian marine fauna.

The number of Australian species of Mysidacea hitherto known amounts, therefore, to four, and as these were all collected in the same locality, Port Phillip, some indication is given of the amount of work which still remains to be done before the Mysid fauna of Australia can be said to be at all adequately known. All but one of the known Australian species of Mysidacea, *Pseudomma australe*, are included in the small collection received from the South Australian Museum, so that this report may be considered as covering all that is at present known of the Mysidacea of these waters.

There is nothing very peculiar or distinctive about the Mysid fauna of Australia as revealed by the present collection. Its affinities, as far as can be

gleaned from this material, lie with the Indian Ocean and Western Pacific fauna. The genera *Siriella, Leptomysis, Anisomysis,* and *Heteromysis* are represented in both areas, and the species are closely allied. The genera *Paranchialina* and *Australomysis* are so far peculiar to Australia.

The most striking fact in the collection is the absence of the genus *Tenagomysis,* which is so characteristic of New Zealand waters. Six species of the genus were collected off New Zealand in considerable quantities by the "Terra Nova" (Tattersall, 6), and altogether nine species of the genus are known, all from these seas; its absence from Australian waters is therefore somewhat remarkable.

FAMILY MYSIDAE.

SUB-FAMILY SIRIELLINAE.

SIRIELLA Dana.

This genus already includes a large number of species, but none of them has up to now been recorded from Australia, if we except the oceanic species, *S. thompsonii,* recorded by the "Challenger" on its voyage from Sydney to Wellington.

In the collection submitted to me by the South Australian Museum there are three species of this genus, all of which appear to be new to science. They may be distinguished by the following key:

1. Large; rostral plate hardly produced in the mid-dorsal line, but produced into prominent pointed shoulders over the eyes .. .. *halei* sp. nov.
2. Small; carapace not produced into shoulders over the eyes.
   (a) Rostral plate broadly rounded in the mid-dorsal line and hardly produced at all. Telson broadly linguiform in shape, with three pairs of spines on the apex. Sixth joint of the thoracic limbs undivided. Spines on inner uropod not in series .. *vincenti* sp. nov.
   (b) Rostral plate produced into an acute triangular plate. Telson narrowly linguiform in shape, with only two pairs of spines at apex. Sixth joint of the thoracic limbs divided into two sub-joints. Spines on inner uropod in series or groups .. *australis* sp. nov.

SIRIELLA HALEI, sp. nov.

Carapace short, leaving the last thoracic somite uncovered; front margin of the carapace hardly produced into a rostral plate, broadly rounded in the mid-dorsal line, produced into quite prominent shoulders over the outside margins

of the eyes, these shoulders quite as long as and much more acute than the median rostral plate; antero-lateral corners of the carapace rounded. Below the median broadly rounded rostral plate is a prominent acute spine, forming a conspicuous

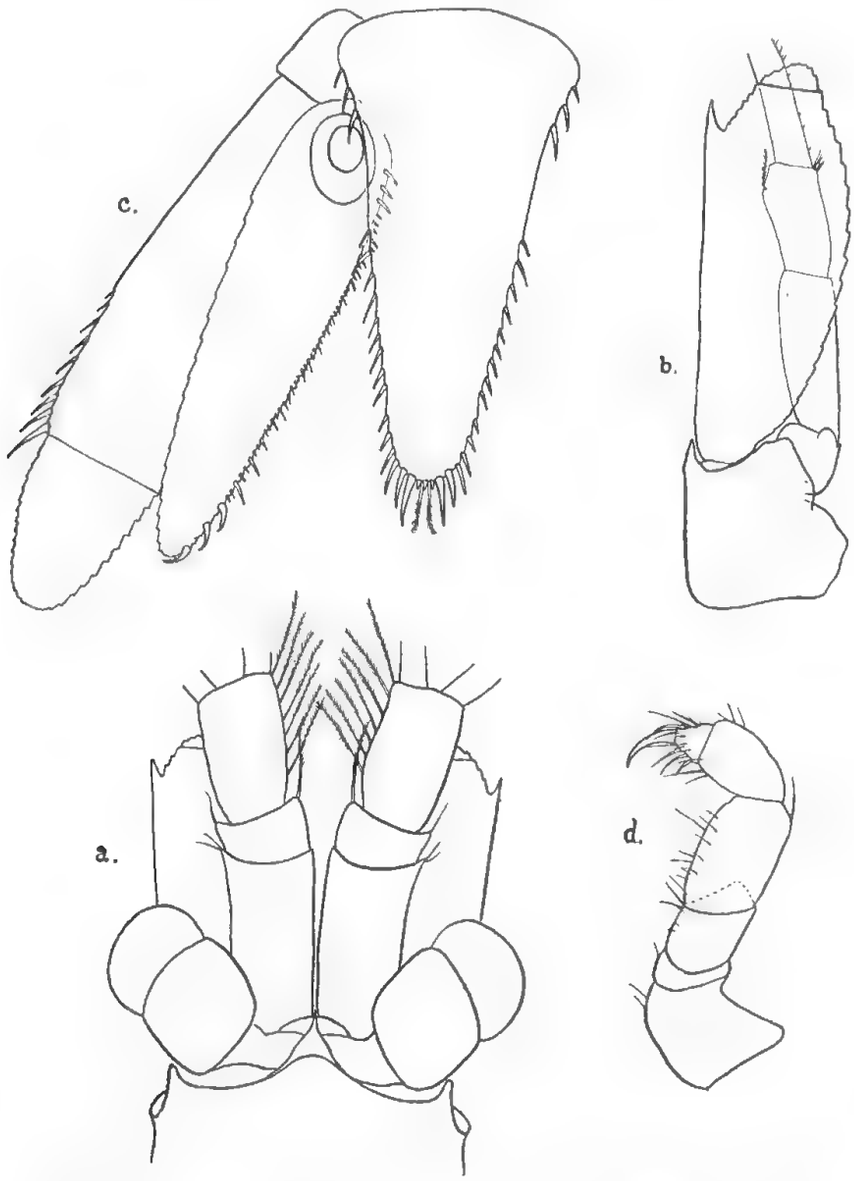

Fig. 95. *Siriella halei; a,* dorsal view of anterior end of female (32 diam.); *b,* antennal scale and peduncle (39 diam.); *c,* telson and uropod (39 diam.); *d,* endopod of first thoracic limb of female (39 diam.).

pseudo-rostral process. *Eyes* of moderate size, shorter than the first joint of the antennular peduncle, one and two-thirds times as long as broad, cornea occupying the distal third of the eye, pigment black. *Antennular peduncle* with the first joint very nearly as long as the second and third combined; third joint twice as long as the second, with a row of nine or ten long, plumose setae on the inner

margin; a single long, plumose seta on the inner distal corner of the second joint. *Antennal scale* not extending quite so far forwards as the antennular peduncle, three times as long as broad, outer marginal spine very prominent, terminal lobe

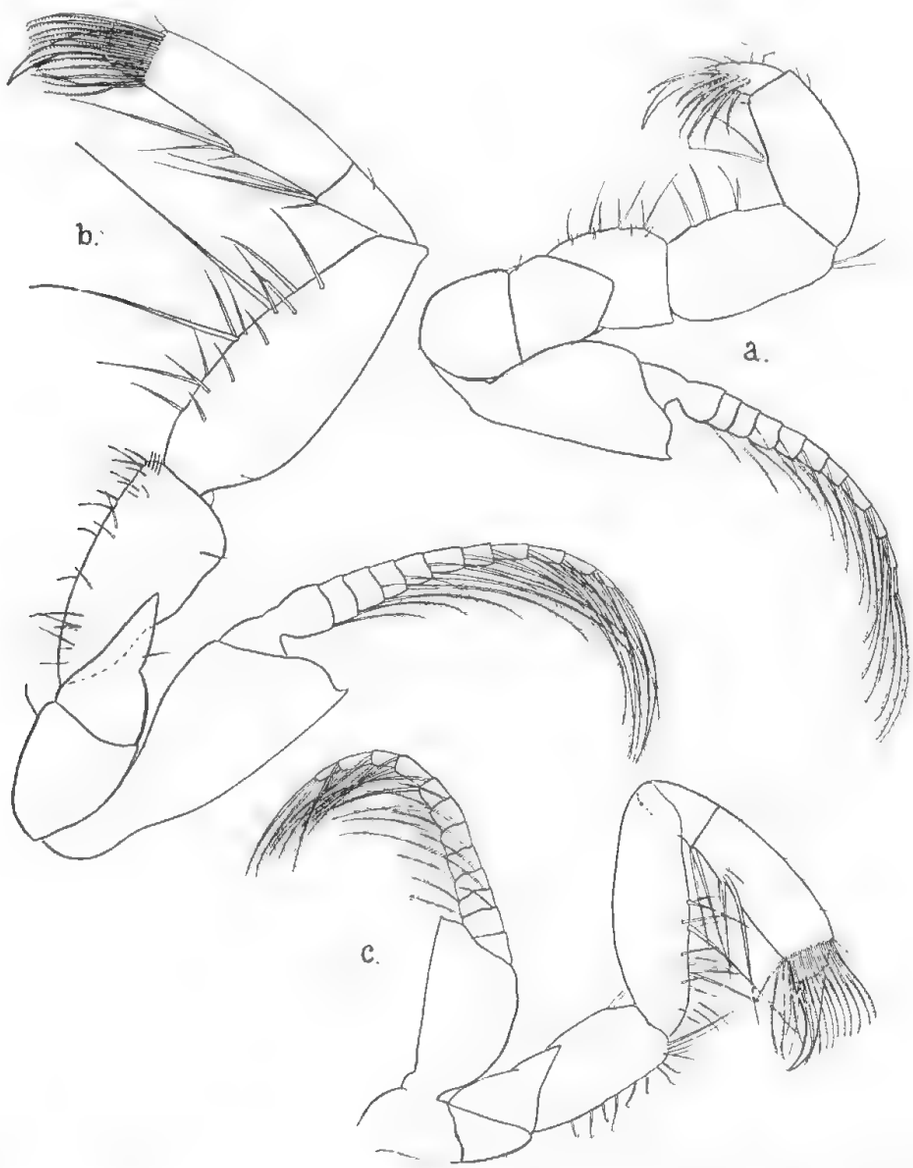

Fig. 96. *Siriella halei; a, b,* and *c,* second, third, and eighth thoracic limbs (39 diam.).

second joint one and a half times as long as the third; a prominent spine on the outer distal corner of the joint from which the scale arises. The *thoracic limbs* are best described by reference to the accompanying figures. They are robust in build, much stouter than in any other species known to me. The sixth joint of shorter than broad, slightly over-reaching the marginal denticle, a small distal joint marked off by a distinct suture; antennal peduncle shorter than the scale,

the endopod of the third to the eighth pair is divided by an articulation into a short proximal and a long distal portion. The basal plate of the exopods is acutely pointed at the outer distal corner, and the flagellum of the exopod is composed of eleven or twelve joints. *Sixth abdominal somite* at least one and a half times as long as the fifth. *Telson* slightly longer than the last abdominal somite, about as long as the proximal portion of the outer uropod and twice as long as broad at the base, with eighteen spines on its lateral margins, three at the proximal end being larger than the remainder and separated from them by a short unarmed interval. The remaining fifteen increase more or less regularly in size to the terminal spines, which are about one-ninth of the length of the telson; there is only a single pair of spines at the apex, and between them are three small subequal spinules and a pair of plumose setae. *Inner uropods* one quarter longer than the telson, with a closely set row of spines on the lower inner margin from the statocyst to the apex; these spines are arranged in series of two, three, or four, the distal five or six spines very large and slightly recurved, without smaller spines between them. *Outer uropods* half as long again as the telson, the distal joint about one-quarter of the whole and one and a half times as long as broad; distal third of the outer margin of the proximal joint with a row of nine graded spines. *Pseudobranchial rami* of the second to the fourth pleopods of the male spirally coiled; distal setae of both rami of the third and fourth pleopods unmodified.

Length. Immature females with the brood pouch just developing, 12 mm.; apparently mature male, 12 mm.

Loc. South Australia: Gulf St. Vincent, 6 miles off Semaphore, 6-7 fathoms, and 5 miles off Semaphore, 5 fathoms (H. M. Hale). Syntypes in South Australian Museum, Reg. No. C. 1614.

Two immature females and one apparently mature male were collected. This species is evidently a large one, probably reaching 16 mm. when fully grown. In general habitus it recalls such large littoral species as *S. armata* and *S. frontalis*, but it is quite distinct from any species known to me in the form of the front margin of the carapace and by the robust character of the thoracic limbs.

I have pleasure in associating this very well-marked species with the name of Mr. H. M. Hale, who has himself collected nearly the whole of the material on which this report is based, and who has spared no pains to meet my request for Australian Mysidae.

SIRIELLA VINCENTI sp. nov.

Carapace short, leaving the last thoracic somite uncovered; front margin only slightly produced as a short, evenly rounded rostral plate not completely

covering the eye-stalks; a prominent pseudo-rostral spine below the rostral plate and projecting in front of the latter. *Eyes* of moderate size, as long as the first joint of the antennular peduncle, one and a half times as long as broad, cornae

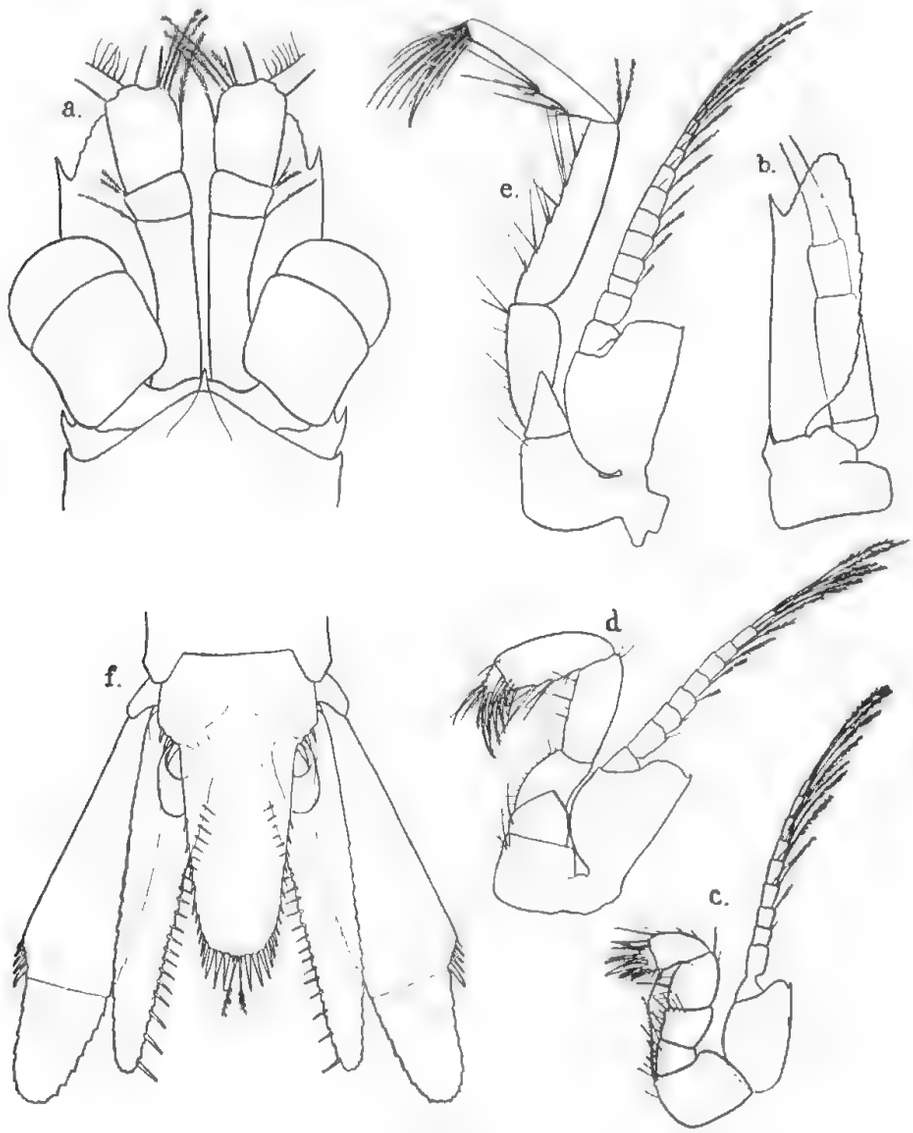

Fig. 97. *Siriella vincenti; a*, dorsal view of anterior end of female; *b*, antennal scale and peduncle; *c*, *d*, and *e*, first, second, and third thoracic limbs; *f*, telson and uropods (39 diam.).

occupying about one-third of the whole eye, pigment black. *Antennal scale* very nearly as long as the antennular peduncle, three and a quarter times as long as broad, marginal spine prominent, terminal lobe about as long as broad, considerably over-reaching the marginal spine, no distal articulation marking off a terminal joint. *Antennal peduncle* shorter than the scale, second joint two and a half times as long as the third; a prominent spine on the outer distal corner of

the joint from which the scale arises. The *thoracic limbs* are best described by reference to the accompanying figures. The first and second pairs are moderately robust and short, the second being considerably shorter than the corresponding limb in *S. australis* (see p. 254, fig. 99). The remaining limbs are moderately slender, with the sixth joint undivided, as far as I can see. The basal plate of the exopod is acutely pointed at the outer distal corner, and the flagellum is composed of nine to twelve joints. *Sixth abdominal somite* one and a half times as long as the fifth. *Telson* as long as the last abdominal somite and twice as long as broad at the base, broadly linguiform in shape, apex rather broadly rounded and about one-sixth of the length of the telson in breadth; lateral margins with three large, stout spines proximally, followed by a short unarmed portion, then a series of fifteen spines on each side, increasing generally in size to the apex, the last three spines on each side actually on the apex, larger than the rest, the central pair about one-eighth of the telson in length; three sub-equal spinules and a pair of long plumose setae, longer than the terminal spines, between the central pair of spines of the apex. *Inner uropods* one-third longer than the telson, with a row of prominent spines on the inner margin, increasing regularly in size towards the apex, and not arranged in series or groups. *Outer uropods* half as long again as the telson; distal joint one and a half times as long as broad; distal end of the outer margin of the proximal joint with a group of five graded spines. *Pseudobranchial rami* of the second to the fourth pairs of pleopods of the male spirally twisted; none of the distal setae of the third and fourth pleopods modified.

Length. Three males and eight females; up to 8 mm. for adults of both sexes.

Loc. South Australia: Gulf St. Vincent, 6 miles off Semaphore, 6-7 fathoms (H. M. Hale). Syntypes in South Australian Museum, Reg. No. C. 1615.

Compared with the following species *(S. australis)*, *S. vincenti* shows the following points of difference:

(1) Rostral plate shorter and bluntly rounded.
(2) Antennular peduncle and eye longer and less robust.
(3) First and second thoracic limbs, especially the second, with the endopods shorter and stouter.
(4) Sixth joint of the endopod of the third to the eighth thoracic limbs unjointed.
(5) Telson broadly linguiform in shape.
(6) Spines on the inner uropod not arranged in groups or series.

Among the large number of species of the genus already described, *S. vincenti* approaches very closely to *S. quadrispinosa* Hansen (3). The telson has the same broadly linguiform shape and a similar armature, except that in *S. vincenti* there are three pairs of spines on the apex, the central pair of which

are the longest, whereas in *S. quadrispinosa* there are two pairs of spines on the apex, the outer pair of which are the longer. *S. vincenti*, however, differs from *S. quadrispinosa* in the shorter and bluntly rounded rostral plate, in the unjointed antennal scale and sixth joint of the thoracic limbs, in the arrangement of the spines on the inner uropod, and in the fewer number of spines on the outer uropod. *S. vincenti* is perhaps still more nearly related to *S. hanseni* Tattersall (6), but has a longer telson and more spines on both inner and outer uropods. In both species the scale is unjointed, and the sixth joint of the thoracic limbs undivided.

SIRIELLA AUSTRALIS sp. nov.

Carapace short, leaving the last and part of the penultimate thoracic somites exposed; front margin produced into an acutely triangular rostral plate covering the eye-stalks; no pseudo-rostral process observed. *Eyes* shorter and broader

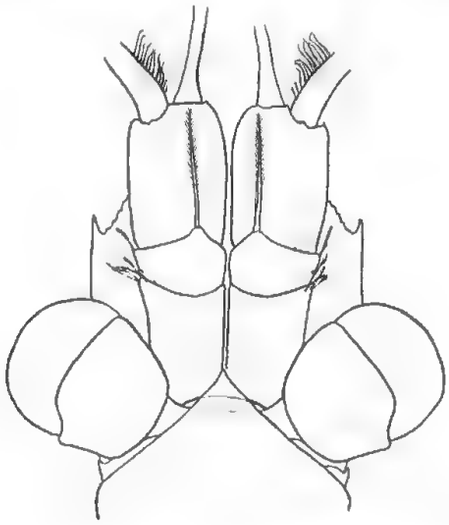

Fig. 98. *Siriella australis:* dorsal view of anterior end of female (22 diam.).

than in *S. vincenti*, nearly as broad as long, cornea occupying nearly one-half of the eye, pigment black. *Antennular peduncle* with the third joint as long as the first; a long, stout seta on the dorsal surface of the second joint near the inside of the front margin; this seta is as long as the third joint and more robust in the male than in the female. *Antennal scale* extending about half-way along the last joint of the antennular peduncle, three times as long as broad, marginal spine prominent, terminal lobe slightly broader than long, and considerably overreaching the marginal spine, no distal articulation. *Antennal peduncle* shorter than the scale, second joint three times as long as the third. The *thoracic limbs* are best described by reference to the accompanying figures. The first limb is moderately robust and short, but the second limb has the endopod relatively

much longer and slenderer than in *S. vincenti*, chiefly owing to the elongation of the fifth and sixth joints. The remaining limbs are slender and long, with the sixth joint divided into two, the proximal portion slightly shorter than the distal. The nail is relatively long, with a prominent spine on the inner margin. The basal plate of the exopod is acutely pointed at the outer distal corner, and the flagellum is composed of from nine to twelve joints. *Sixth abdominal somite* one and a half times as long as the fifth. *Telson* slightly longer than the last abdominal somite, narrowly linguiform in shape, two and a half times as long as broad at the base, apex rather narrow and equal in breadth to one-third of the base, lateral margins with two prominent spines proximally at the base, followed by a short unarmed portion and then a series of fourteen spines increasing generally in size towards the apex, the last spine the longest and about one-eighth of the telson in length; between the central pair of spines at the apex are situated three equal spinules and a pair of plumose setae as long as the terminal spines. *Inner uropod* one-third longer than the telson, with a row of prominent spines on the inner margin arranged in series, particularly towards the apex. *Outer uropod* only slightly longer than the inner and about one and a half times as long as the telson, distal joint one and three-quarter times as long as broad, proximal joint with a group of four to six graded spines at its distal end. *Pseudo-branchial rami* of the second to the fourth pair of pleopods of the male spirally twisted; none of the setae on the male pleopods modified.

Length. Adult male 10 mm.; adult female 8 mm.

Loc. South Australia: Gulf St. Vincent, 6 miles off Semaphore, 6-7 fathoms, and 5 miles off Semaphore, 5 fathoms (H. M. Hale). Syntypes in South Australian Museum, Reg. No. C. 1616.

Four examples of each sex were taken. *S. australis* may be distinguished from *S. vincenti* by the following characters:

(1) The longer and more acute rostral plate and the absence of a pseudo-rostral spine.
(2) The shorter and stouter eyes and antennular peduncle.
(3) Sixth joint of the endopod of the thoracic limbs divided into two sub-joints.
(4) Spines on the inner uropod arranged in groups.
(5) Telson rather longer and more narrowly linguiform in shape.

Among described species of the genus *S. australis* appears to be most nearly related to *S. vulgaris* and *S. affinis*, described by Hansen from the waters of the East Indian Archipelago. It differs, however, from both of these species in the unjointed antennal scale. The telson has the same narrowly linguiform shape in all three, and the spines arming its lateral margins increase regularly in length

towards the apex, and are not arranged in groups. *S. australis* agrees with *S. vulgaris* in the character and arrangement of the spines on the inner uropod.

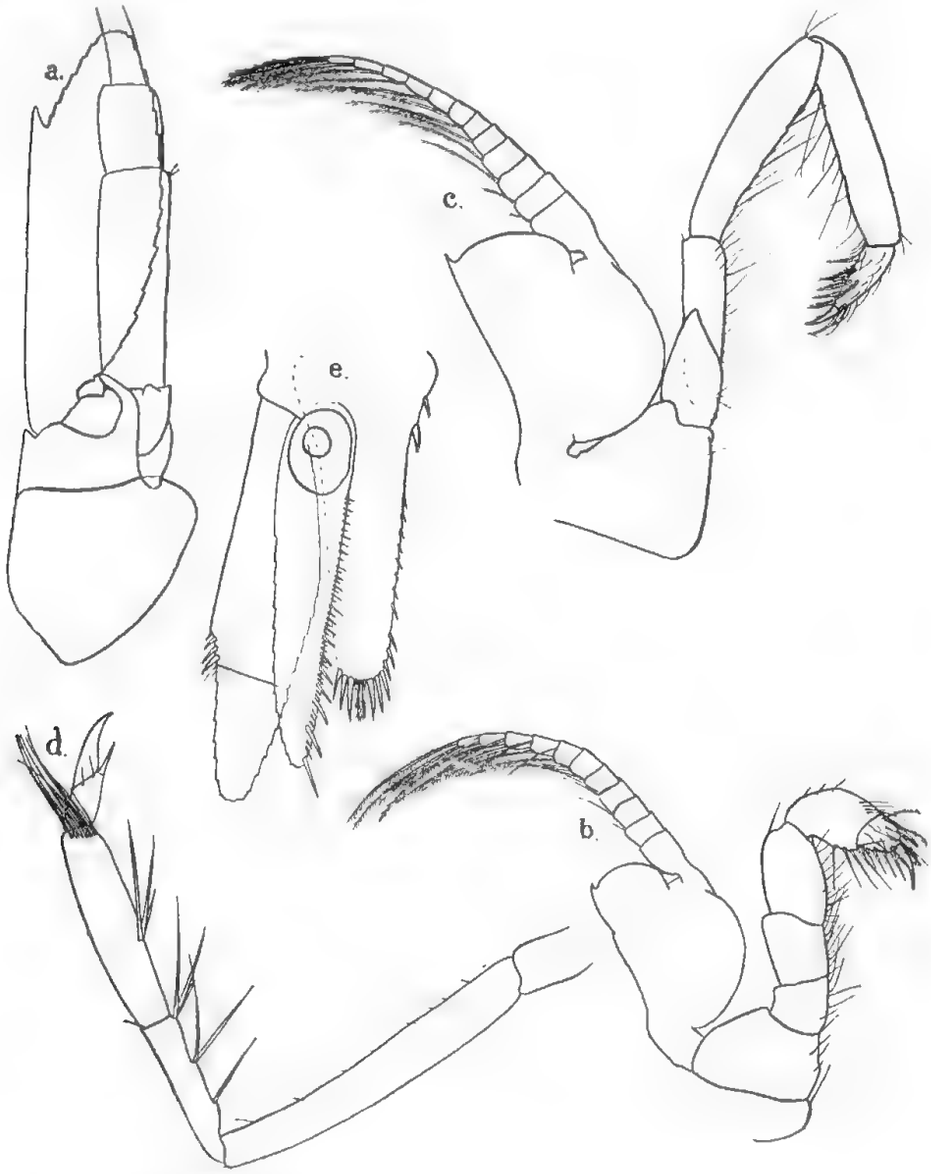

Fig. 99. *Siriella australis; a,* antennal scale and peduncle (39 diam.); *b* and *c,* first and second thoracic limbs (39 diam.); *d,* endopod (distal joints) of third thoracic limb (50 diam.); *e,* telson and uropod (39 diam.).

A specimen of *Siriella* from the following locality, Kingscote, north coast of Kangaroo Island, South Australia, ½ fathom (H. M. Hale), is probably to be referred to this species, but the telson has been broken off, and its identity must therefore remain doubtful.

Some years ago the late Professor S. J. Johnston gave me some specimens of a *Siriella* obtained by tow-netting at Port Hacking, New South Wales. The

specimens are in poor condition, but appear to agree in the main with *S. australis*, except that the spines on the lateral margins of the telson are more numerous (twenty-two as against fourteen).

SUB-FAMILY GASTROSACCINAE Norman.

PARANCHIALINA Hansen.

Anchialus (pars.) G. O. Sars, 1883, 1885.
Paranchialina Hansen, 1910, p. 51.

Hansen (3) established this genus for the species, *Anchialus angustus* G. O. Sars, found by the Challenger Expedition at the entrance to Port Philip, Victoria. It is distinguished from *Anchialina* by the following features: Body is slender, carapace leaving uncovered the whole of the last thoracic somite and part of the preceding somite, first thoracic limb (maxilliped) with a prominent lobe from the second joint, second and third thoracic limbs without sexual differences, first three pleopods of the female normal and styliform, last two pairs in the form of transverse lamellae, no pseudo-branchial lamellae on the pleopods of either sex, uropod with only two spines near the middle of its outer margin, proximal portion of this margin unarmed, distal portion setiferous.

PARANCHIALINA ANGUSTA G. O. Sars.

Anchialus angustus G. O. Sars, 1883, p. 39, and 1885, p. 197, pl. xxxv, fig. 1-18.
Paranchialana angusta Hansen, 1910, p. 51.

A male and female, and two adult females with brood lamellae and young in the brood pouch are before me. The male is 7 mm. in length, the females are each 8 mm. in length.

Loc. South Australia: Gulf St. Vincent, 6 miles off Semaphore, 6-7 fathoms, and 5 miles off Semaphore, 5 fathoms (H. M. Hale).

Sars' description and figures are adequate for the identification of this species. The body is minutely hispid all over, most markedly on the eye-stalks and along the lateral portions of the abdomen.

Sars gives the number of spines on the lateral margins of the telson as from twenty to thirty, in specimens of 10 mm. The present specimens, 8 mm. in length, have only about thirteen to fifteen spines.

The pleopods of the male have been described by Sars. He was, however, in error in stating that the exopod of the fourth pair is elongated. Hansen has correctly noted that it is the exopod of the third pair which is elongated. The first and fifth pleopods of the male have only the endopod present, while the second and fourth pairs have both exopod and endopod present and more or less equal in length.

Prior to the specimens here recorded, the "Challenger" material of two adult females and one broken male, from the entrance to Port Phillip, comprised the whole of the known specimens of this species. It is, therefore, as far as present knowledge goes, only known from Australian waters.

SUB-FAMILY MYSINAE.

LEPTOMYSIS G. O. Sars.

LEPTOMYSIS AUSTRALIENSIS sp. nov.

Carapace short, leaving the last thoracic somite completely uncovered, front margin produced between the eyes into a triangular, bluntly pointed rostral plate, extending about one-quarter along the basal joint of the antennular peduncle, covering the eye-stalks but leaving the eyes themselves exposed; antero-lateral corners rounded. *Eyes* large, as long as the first joint of the antennular peduncle, rather longer than broad, cornea occupying rather more than half the eye, pigment black. *Antennal scale* very long and narrow, extending for quite half its length beyond the antennular peduncle, eight times as long as broad, setose all round, apex narrowly rounded, a small terminal joint marked off by a distinct suture. *Antennal peduncle* about one-third as long as the scale, second joint longer than the third. The *thoracic limbs* are best described by reference to the accompanying figures. They are robust in build. The sixth joint of the endopod of the third to the eighth pair is divided into three or four sub-joints, the whole joint about as long as the fifth, nail long and slender. The basal plate of the exopods is acutely pointed at its outer distal corner, and the flagellum is composed of eight or nine joints. *Sixth abdominal somite* one and a half times as long as the fifth. *Telson* slightly shorter than the sixth abdominal somite, entire, narrowly linguiform in shape, gradually narrowing to a bluntly rounded apex, distal part not expanded as in *L. lingvura*, about twice as long as broad at base, lateral margins armed with about fifty closely-set spines, not arranged in series, gradually increasing in size distally, the terminal pair of spines at the apex about one-ninth of the telson in length, no plumose setae. *Inner uropod* one and a quarter times as long as the telson, with a prominent spiniform, blunt projection on the dorsal face of the statocyst, near the postero-lateral outer corner, visible in dorsal view; inner ventral margin of the uropod with a row of seven spines, increasing in length distally, four of them on the statocyst, the remaining three distal to the statocyst and widely separated, the last spine long and stout, and situated about the centre of the lower inner margin; a series of small spinules round the inner margin of the statocyst. *Outer uropods* about one-third longer than the inner. *Pleopods* of the characteristic form met with in the genus. The

exopod of the fourth pair in the male is longer than the endopod, and has modified setae on the last four joints. On each of the third and fourth joints from the apex there is a single very powerful seta, with the distal half transversely striated. On the penultimate joint there is a single stout plumose seta,

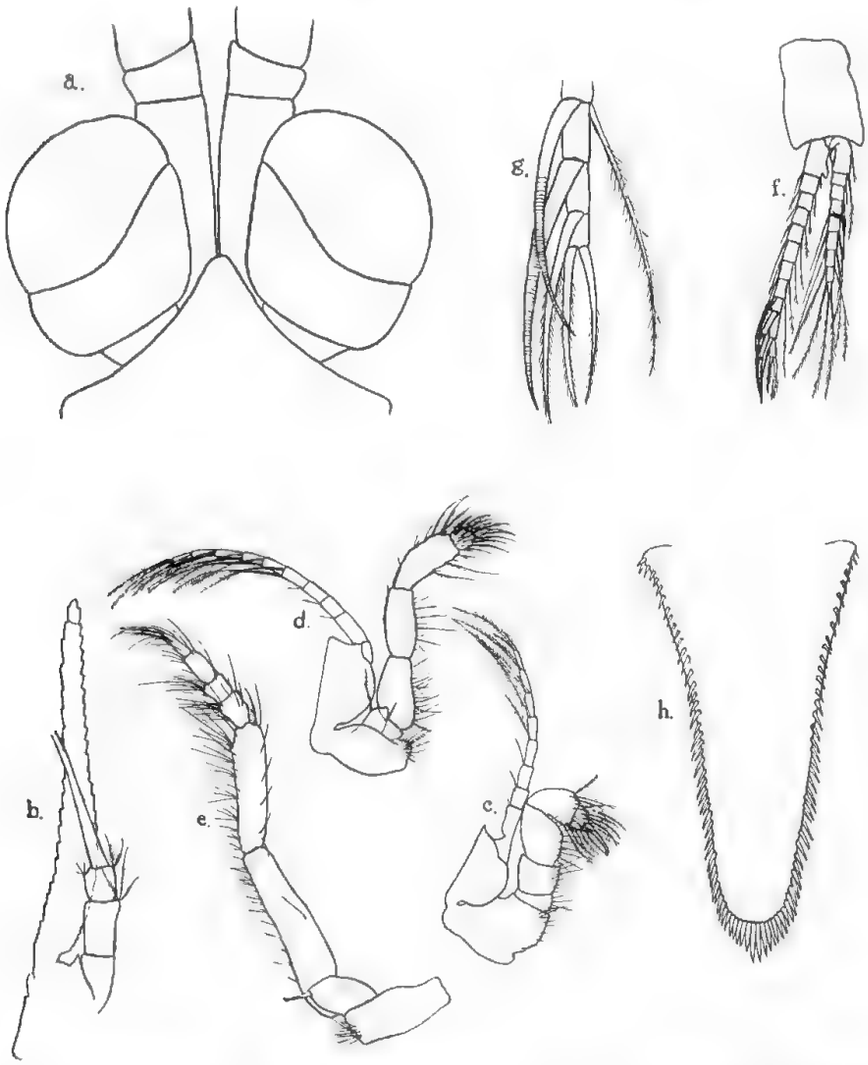

Fig. 100. *Leptomysis australiensis; a,* anterior end to show rostral plate and eyes (39 diam.); *b,* antennal scale and peduncle (21 diam.); *c* and *d,* first and second thoracic limbs (21 diam.); *e,* endopod of third thoracic limb (21 diam.); *f,* fourth pleopod of male (21 diam.); *g,* distal joints of exopod of fourth pleopod of male (180 diam.); *h,* telson (39 diam.).

while the terminal joint ends in two moderately long and stout setae, which are sparsely plumose.

Length. Adult specimens of both sexes, 12 mm.

Loc. South Australia: Gulf St. Vincent, 6 miles off Semaphore, 6-7 fathoms, and 5 miles off Semaphore, 5 fathoms (H. M. Hale). Syntypes in South Australian Museum, Reg. No. C. 1617.

This is a characteristic species of the genus, distinguished from described species by the combination of characters provided by the extreme length and narrowness of the antennal scale, the shape and armature of the telson, the sixth joint of the endopod of the third to the eighth thoracic limbs, and the fourth pleopod of the male.

I have received several specimens from Mr. Hale, taken at various points in Gulf St. Vincent, in 5-6 fathoms of water. The species appears to be quite common in the Gulf.

AUSTRALOMYSIS gen. nov.

Mandible with a well-developed molar process; second maxilla with the setiform lobe on the second joint well developed; antennal scale lanceolate-oval in shape, setose all round, with a distal articulation; first thoracic limbs with a large lobe from the second joint and a well-developed lobe from the third, second and third joints not coalesced; sixth joint of the endopod of the third to the eighth thoracic limbs divided by one or two articulations; telson cleft, the cleft armed with teeth, but without plumose setae; inner uropods with a row of spines on the inner margin; pleopods of the male as in the genus *Leptomysis*, exopod of the fourth pair larger than the endopod, with modified setae on the last three joints; three pairs of brood lamellae in the female.

Type. *Mysidopsis incisa* G. O. Sars.

The single type specimen, and up till now the only recorded one, of *Mysidopsis incisa* was taken by the Challenger Expedition in Port Philip, Victoria. It was not dissected by Sars, and was referred on other characters to the genus *Mysidopsis*. In the material forwarded to me from the South Australian Museum are several specimens which are clearly referable to Sars' species, but on dissection prove to differ widely from *Mysidopsis* in the character of the mouth parts and to approach much more closely to *Leptomysis*. In *Mysidopsis* the mandible lacks a molar process, the lobe from the second joint of the maxilla lacks the broad setiferous expansion, and the second and third joints of the endopods of the first thoracic limbs are fused. In all these points *M. incisa* differs from *Mysidopsis* and agrees with *Leptomysis*. It is clear that the species cannot remain in the genus *Mysidopsis*. The species differs from *Leptomysis* in the form of the telson, which is cleft, the cleft armed with teeth, whereas in *Leptomysis* it is entire. The fourth pleopods of the male differ slightly from those of *Leptomysis*, and the sixth joint of the endopod of the third to the eighth thoracic limbs has but one or two articulations. These characters combined appear to be of generic value, and I therefore propose this new genus to include *Mysidopsis incisa* G. O. Sars and a second species found in the present material. The genus is not unlike *Doxomysis*, but lacks plumose setae at the apex of the telson. It differs from *Mysidetes* in the characters of the pleopods of the male.

AUSTRALOMYSIS INCISA G. O. Sars.

Mysidopsis incisa G. O. Sars, 1884 and 1885, p. 202, pl. xxxv, fig. 21-23.

Thirteen females and five males, up to 7 mm. in length, were taken in January of last year.

Loc. South Australia: Vivonne Bay, south coast of Kangaroo Island, 3-3½ fathoms (H. M. Hale).

Sars' description is adequate for the recognition of this species. A few notes on certain features are added for comparison with the new species described below. The antennal scale is four times as long as broad, with a well-marked distal articulation. The proximal portion of the eye is minutely spinulose, and the whole eye is broader and more flattened than in the next species. The rostral

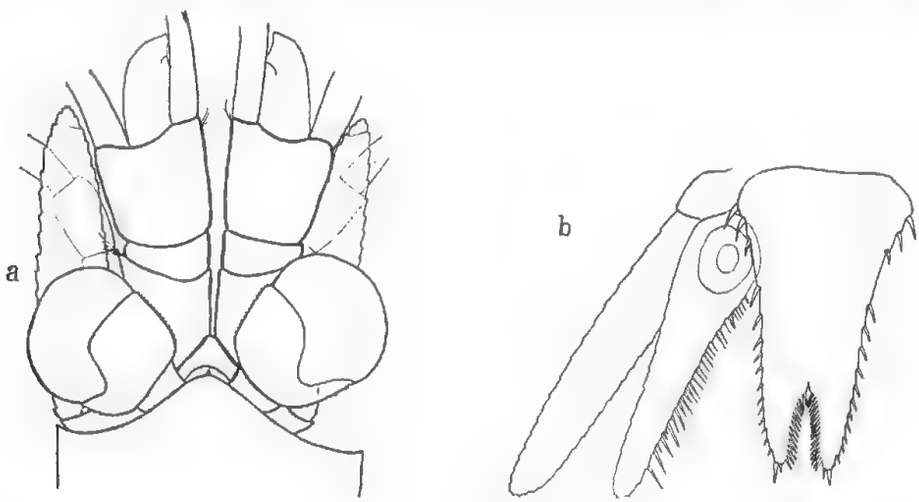

Fig. 101. *Australomysis incisa; a*, dorsal view of anterior end of male; *b*, telson and uropods (38 diam.).

plate is short and bluntly rounded, and there is a short pseudo-rostral process beneath. The antero-lateral corners of the carapace are rounded. The articulations dividing the sixth joint of the endopod of the thoracic limbs are transverse, and not oblique. There is a short but distinct gap between the proximal three and the remaining spines arming the lateral margins of the telson. The spines on the inner uropod are arranged in series of two or three, except towards the apex.

AUSTRALOMYSIS ACUTA sp. nov.

Carapace with the front margin produced as a conspicuous acutely pointed rostral plate not covering the eye-stalks; antero-lateral corners of the carapace acutely pointed; below the rostral plate there is a conspicuous pseudo-rostral process tipped by a single seta. *Eyes* about twice as long as broad, not flattened, cornea occupying the distal third; eye not hispid. *Antennal scale* four times as

long as broad, with a distal joint. *Thoracic limbs* with the endopods having the sixth joint divided by a single oblique articulation into a longer proximal and a shorter distal portion; nail short, with a short spine on the inner margin. *Telson*

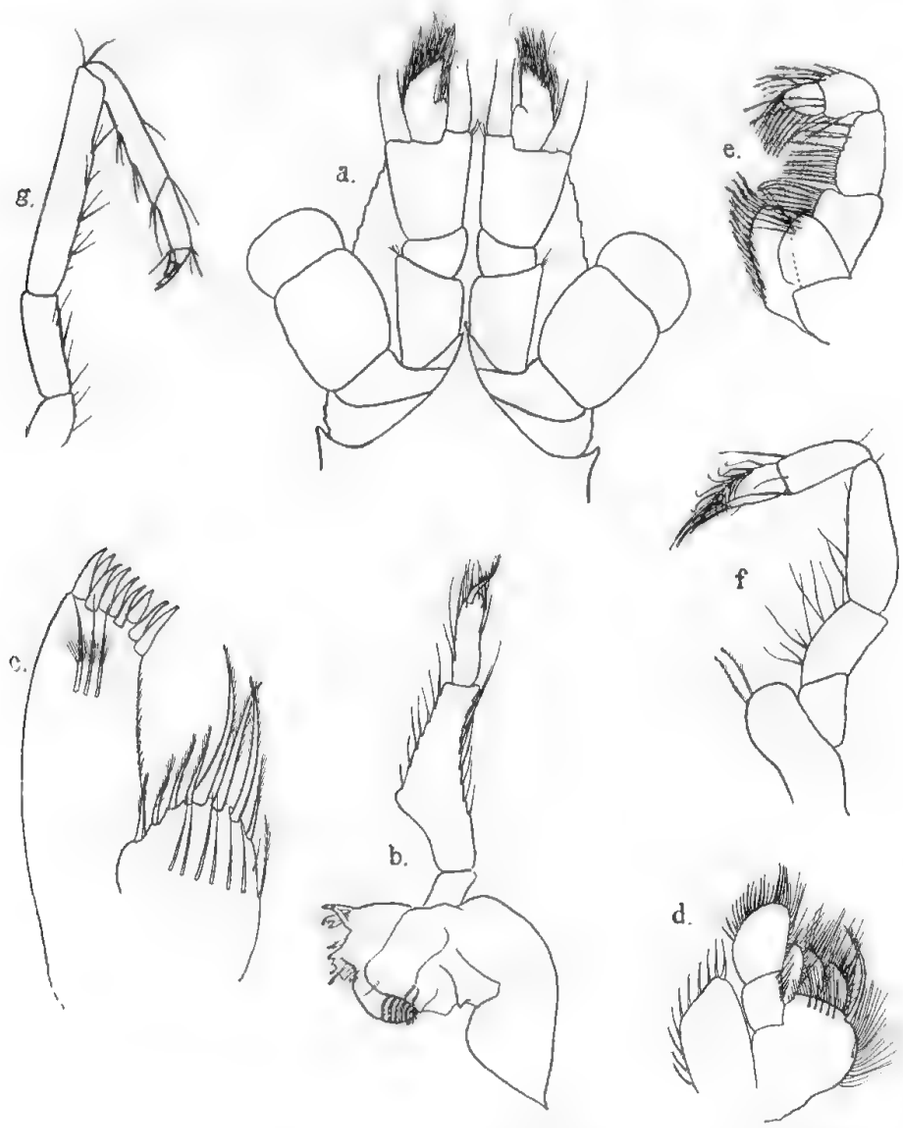

Fig 102. *Australomysis acuta; a,* dorsal view of anterior end of male (39 diam.); *b,* mandible (50 diam.); *c,* first maxilla (180 diam.); *d,* second maxilla (50 diam.); *e* and *f,* endopod of first and second thoracic limbs (50 diam.); *g,* distal joints of endopod of third thoracic limb (50 diam.).

one-quarter longer than the sixth somite of the abdomen, nearly twice as long as broad at the base, narrowing to an apex, which is only one-third of the width at the base, apex cleft, the cleft about one-fifth of the total length of the telson, and armed with teeth on each margin but no plumose setae; lateral margins of the telson armed with about eighteen spines, distributed throughout the entire

length of the margins, without any unarmed interval, the terminal spine one-ninth of the length of the telson. *Inner uropod* only slightly longer than the telson, with a row of twenty-two spines on the lower inner margin from the statocyst to quite near the apex, these spines becoming longer and more distantly placed distally, but not arranged in groups or series. *Outer uropod* one and a half times as long as the telson. *Pleopods* of the male essentially as in the genus *Leptomysis*. Exopod of the fourth pair longer than the endopod, with a powerful plumose seta on the antepenultimate and penultimate joints, the terminal joint with two long, equal, slender, smooth, spiniform setae.

Length. Adult male and female, 8 mm.

Loc. South Australia: Gulf St. Vincent, 6 miles off Semaphore, 6-7 fathoms (H. M. Hale).

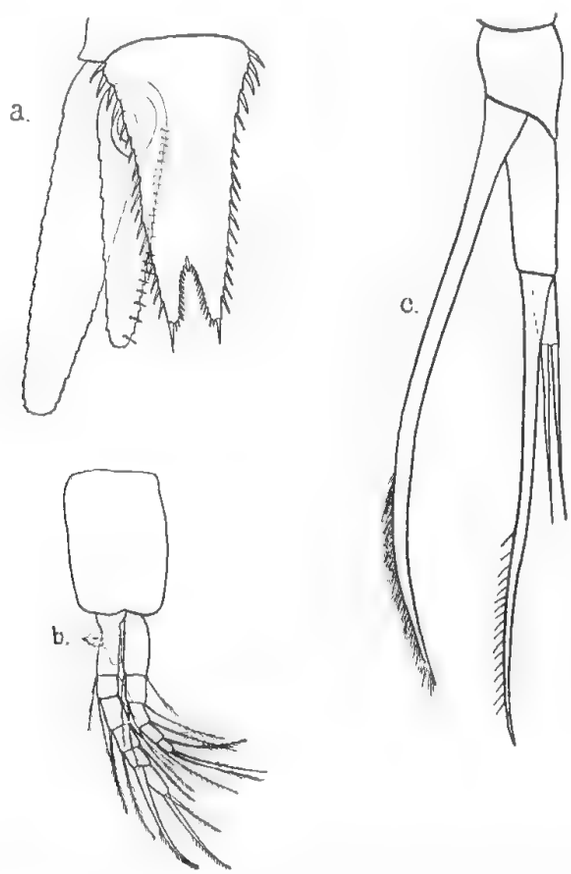

Fig. 103. *Australomysis acuta; a*, telson and uropod (39 diam.); *b*, fourth pleopod of male (39 diam.); *c*, distal joints of exopod of fourth pleopod of male (180 diam.).

In its other features this species agrees essentially with *A. incisa*. The figures of the mouth parts which are given to illustrate the characters of the genus are taken from appendages of *A. acuta*. The mouth parts of *A. incisa* are

substantially the same. The main differences between the two species are best summarized in tabular form:

	A. incisa.	*A. acuta.*
(a) Rostral plate	short, bluntly rounded.	well developed, acute.
(b) Antero-lateral angles of the carapace	rounded.	acutely pointed.
(c) Eye	short and broad, flattened dorso-ventrally.	rather longer and narrower and not flattened.
(d) Telson	with a short unarmed portion of the lateral margins.	spines of the later margin forming a continuous series.
(e) Inner uropod	spines arranged in groups of two or three.	spines not grouped.
(f) Sixth joint of the endopods of thoracic limbs	divided by two transverse articulations.	divided by one oblique articulation.

The last of these differences is interesting and peculiar. Hansen (3) says that oblique articulations are known only in the tribe *Erythropini*, but I have already noted them in a species of *Doxomysis*, which also belongs to the tribe *Leptomysini*.

TRIBE MYSINAE.

ANISOMYSIS Hansen.

ANISOMYSIS AUSTRALIS Zimmer.

A. australis Zimmer, 1918, p. 22, text figs. 27-32.

There are before me one female from South Australia, and thirteen females and five adult males from New South Wales. I have nothing to add to Zimmer's description, with which these specimens agree completely. Port Phillip is the type locality.

Length. Both sexes, 5 mm.

Loc. South Australia: Vivonne Bay, south coast of Kangaroo Island (H. M. Hale). New South Wales: Port Hacking, in surface tow-net (S. J. Johnston).

TRIBE HETEROMYSINI.

HETEROMYSIS S.I.Smith.

HETEROMYSIS WAITEI sp. nov.

Carapace completely covering the thorax, with the front margin produced into a bluntly triangular rostral plate, not extending beyond the eyes, and in part occluding the eye-stalks. *Eyes* small, longer than wide, cornea occupying less than one-half of the eye in dorsal view, a prominent, acute spine on the upper distal border overhanging the cornea; surface of the eye, except the cornea, spinulose. *Antennular peduncle* with a single stout spine on the inner distal corner of each of the second and third joints. *Antennal scale* as long as its peduncle, extending half-way along the last joint of the antennular peduncle, two and a half times as long as broad, setae all round, a small distal portion divided off by a suture. *Third thoracic limbs* with the endopod moderately short and robust, merus rather more than twice as long as broad, without a process at the distal end of the inner margin, carpus robust, shorter than the merus, twice as long as broad, inner margin armed with two stout spines in the female and four in the male, each spine with a seta inserted near the tip and a row of minute tubercles on distal margin; propodal joint very short and without spines or processes; dactylus half as long as the carpus, and strongly curved. *Remaining thoracic limbs* with the sixth joint of the endopod divided into nine sub-joints, of which the first is the largest; sixth joint equal to the fifth and shorter than the fourth; nail short and curved; outer distal corner of the basal plate of the exopods acuminate. *Sixth abdominal somite* only slightly longer than the fifth. *Telson* one and a half times as long as the sixth abdominal somite, and one and a half times as long as broad at the base; apex one-third as broad as the base, cleft one-fifth of the total length armed with eleven or twelve teeth on each side, extending throughout the entire edges; each lobe of the apex with two spines, the outer about one-eighth of the length of the telson and three times as long as the inner; lateral margins of the telson with fifteen to seventeen spines extending throughout the entire margin, an interval of varying length between the last marginal spine and the terminal spines on the apical lobe. *Inner uropod* one-quarter longer than the telson, with three or four spines on the inner margin near the statocyst. *Outer uropod* half as long again as the telson.

Length. Adult female, 9 mm.; adult male, 11 mm.

Loc. South Australia: Gulf St. Vincent, Outer Harbour (type loc.), and 5 miles off Semaphore, 5 fathoms, and 6 miles off Semaphore, 5 fathoms (H. M. Hale). Type in South Australian Museum, Reg. No. C. 1618.

The type female, two males (8-11 mm.), and two immature specimens, were secured. The young examples, 3·5 mm. and 5 mm. in length, differ from adults in the armature of the cleft of the telson. The teeth on the cleft are fewer in

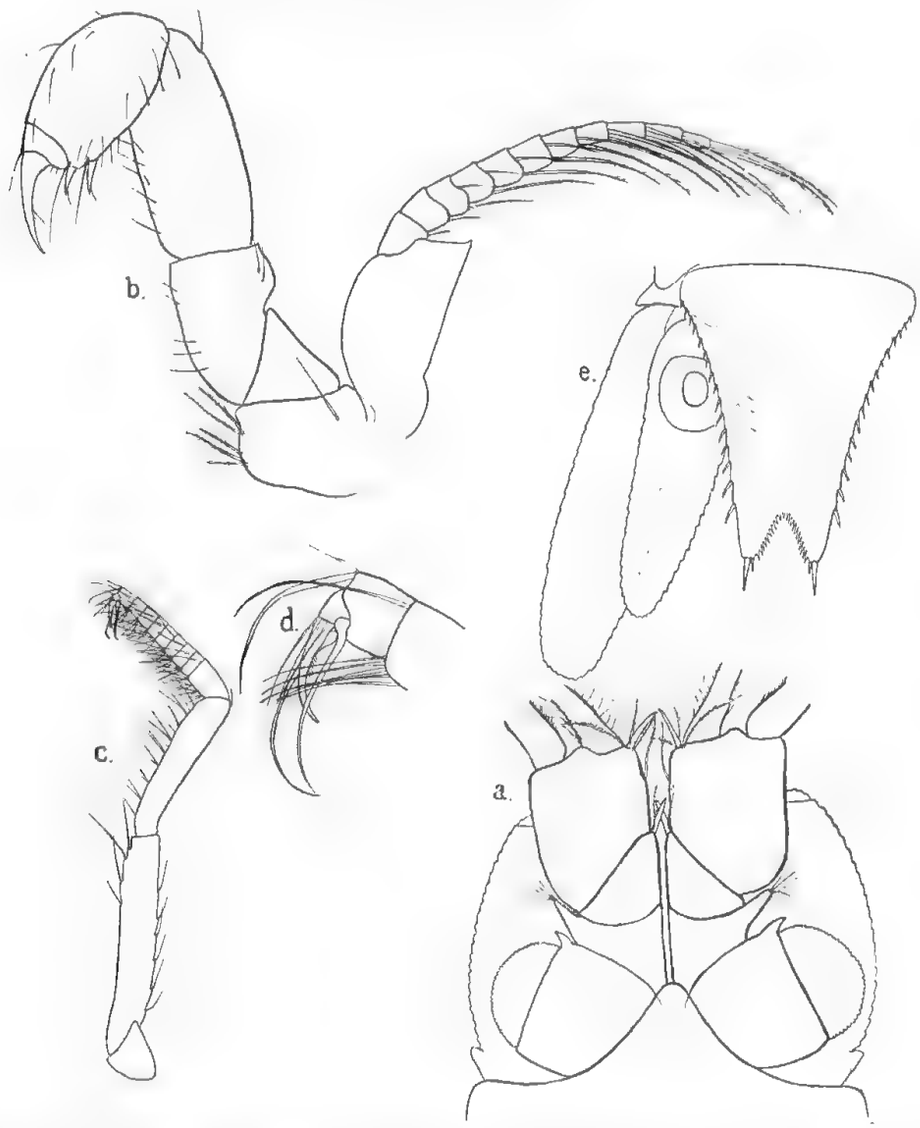

Fig. 104. *Heteromysis waitei; a*, dorsal view of anterior end of female (32 diam.); *b*, third thoracic limb of female (33 diam.); *c*, endopod of fourth thoracic limb of female (33 diam.); *d*, distal extremity of endopod of fourth thoracic limb of female (180 diam.); *e*, telson and uropod (32 diam.).

number, and do not extend along the entire margin, the distal portion of which is smooth and unarmed.

This species is distinguished from the following one by the spine over the eye, the armature of the telson and inner uropods, and the form of the endopod of the third thoracic limb.

H. waitei belongs to the same group of the genus as *H. odontops* Walker and *H. zeylanica* Tattersall, both of which have spiniform processes over the eyes. It is distinguished from the latter by the armature of the telson, the fewer spines on the inner uropod, and the larger number of sub-joints in the sixth joint of the endopod of the thoracic limbs. The carpal joint of the endopod of the third thoracic limb in *H. waitei* is shorter than in *H. zeylanica*, and the whole limb is relatively more robust.

In the light of the young specimens of *H. waitei* in this collection, it seems possible that my description of *H. zeylanica* is based on young specimens, and the differences between the telson in the two species may not hold for adults. In *H. zeylanica* the teeth arming the cleft are confined to the proximal half of its margins, and the spines arming the lateral margins are arranged in two groups, a proximal and a distal, with a short unarmed interval between. From the present observations on *H. waitei* the former character is certainly juvenile, and it seems not unlikely that with increase in size the unarmed interval on the lateral margins will become occupied with spines.

HETEROMYSIS TASMANICA sp. nov.

Carapace completely covering the thorax, with the front margin produced into a pointed, triangular rostral plate, rather more acute than in *H. waitei*, not extending beyond the eyes, and partly covering the eye-stalks. *Eyes* small, longer than wide, cornea occupying about one-third of the eye, no acute spine overlapping the cornea, surface of the eye smooth, pigment black. *Antennal scale* nearly three times as long as broad, setose all round, almost as long as the antennular peduncle, a small distal portion marked off by a suture. *Third thoracic limbs* with the endopod large and robust, merus more than two and a half times as long as broad, without a process at the distal end of the inner margin, carpus robust, longer than the merus and somewhat broader, nearly three times as long as broad, the inner margin armed with a row of nine or ten spines, each with a barbed seta arising from its base, the spines increasing in length and stoutness distally, the last two or three with a blunter apex and one or two subsidiary tubercles on the distal margin, propodal joint small, nail long and curved, with three or four long, barbed setae, as long as the nail, arising at its base. *Remaining thoracic limbs* with the sixth joint of the endopod divided into seven sub-joints; sixth joint shorter than the fifth, which in turn is shorter than the fourth; the whole limb rather more slender than in *H. waitei*; outer distal corner of the basal plate of the exopod rounded. *Sixth abdominal somite* one and a third times as long as the fifth. *Telson* one and a quarter times as long as the sixth abdominal somite, and as broad as the latter is long at the base; apex one-third as broad as the base; telson cleft for one-fifth of

its length, the cleft armed with about twelve teeth on each margin, extending the whole length of the margins; each lobe of the apex armed with two spines, the outer about twice as long as the inner and about one-twelfth of the

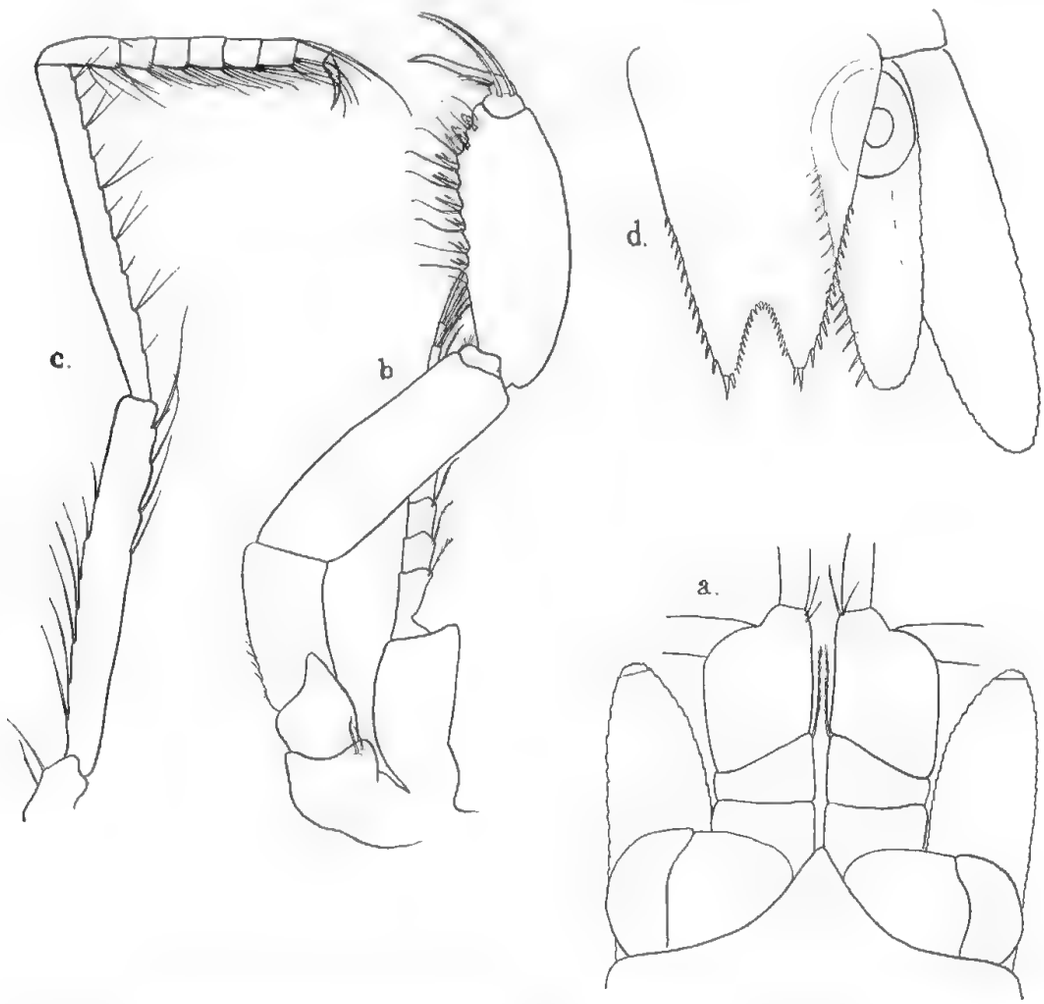

Fig. 105. *Heteromysis tasmanica*; *a*, dorsal view of anterior end of male (32 diam.); *b* and *c*, third thoracic limb, and endopod of fourth thoracic limb of male (22 diam.); *d*, telson and uropod (32 diam.).

length of the telson; lateral margins of the telson armed with about thirteen to fifteen spines on the distal two-thirds only, the proximal third being unarmed. *Inner uropod* slightly longer than the telson, with a row of about sixteen spines on the inner margin, extending from the statocyst nearly to the apex. *Outer uropod* about one-quarter longer than the telson.

Length. Adult males, 12 mm.

Loc. South Australia: Gulf St. Vincent, 5 miles off Semaphore, 5 fathoms (H. M. Hale). Tasmania: D'Entrecasteaux Channel (type loc., W. M. Tattersall).

Three males were secured in Tasmania and one in South Australia. In all these specimens there is a median sausage-shaped process on the sternum of the thorax, attached between the bases of the third thoracic limbs and projecting backwards between the bases of the remaining limbs. There is nothing similar in *H. waitei*, and in the absence of females I am unable to say whether it is a secondary sexual character.

This species belongs to the *H. harpax* group of the genus, and comes nearest to *H. proxima* Tattersall, from Ceylon, from which it is distinguished by the larger number of spines on the inner uropod, by the larger number of sub-joints in the sixth joint of the endopod of the thoracic limbs, and by details of the endopod of the third thoracic limbs. The type specimens were collected by myself when on a visit to Tasmania in 1914. It was therefore not without interest to find a specimen in the collection from South Australia which, though smaller in size, agrees very closely with the Tasmanian specimens, except in the fewer number of spines on the inner uropod (eight) and the fewer teeth in the cleft of the telson (six), characters which vary with age.

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ON THE STAPHYLINIDAE COLLECTED BY MR. A. M. LEA IN FIJI AND NEW CALEDONIA

BY MALCOLM CAMERON, M.B., R.N., F.E.S.

Summary

The collection of Staphylinidae here dealt with was recently made in Fiji and New Caledonia by Mr. Arthur M. Lea, Entomologist of the South Australian Museum, and was sent to me by the Director (Mr. Edgar R. Waite) of that institution, in which all the types are deposited. Levuka, Moturiki, Ovalau, Savu Savu, Taveuni, Viti Levu, Wakaya and Yanuca Lili are Fijian localities, and Noumea is New Caledonian.

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Sub-Family OXYTELINAE.

ELEUSIS HUMILIS Er.

Hab. Ovalau. Widely distributed through the tropics.

ELEUSIS APICIPENNIS Fairm.

Hab. Taveuni, Moturiki, Viti Levu, Ovalau, Savu Savu.

PARALISPINUS LEAI sp. nov.

Shining rufo-testaceous, the fore-parts very finely and very sparingly punctured, strigose. Head bifoveate. Antennae and legs reddish-testaceous. Length, 2 mm.

Closely allied to *P. exiguus* Er., and of similar colour, but smaller, the eyes less prominent, the antennae not quite so stout but similarly constructed, thorax longer and narrower, less deeply sinuate before the posterior angles, median impressed line finer, the ground sculpture less fine. Head impressed on either side within the antennal tubercles, the impressions with a coriaceous ground sculpture, on the disc with a finer longitudinally strigose ground sculpture and with a few very fine punctures. Thorax wider than the head, scarcely broader than long, the sides for the anterior three-fourths almost straight and parallel, the posterior fourth gradually contracted and arcuate, foveate near the rectangular posterior angles; disc with a fine median impressed line posteriorly, and with a few very fine punctures, longitudinally strigose. Elytra as broad as but longer than the thorax, much longer than broad, each with a setigerous puncture on the disc, and with a similar ground sculpture to that of the thorax. Abdomen coriaceous, each segment with a setiferous puncture on either side of the middle, otherwise impunctate.

Hab. Taveuni, Type, I. 16424. Ovalau. Two examples.

LISPINUS SULCIPENNIS Blackb.

Hab. Ovalau, Viti Levu. Also in Australia.

LISPINUS IMPRESSICOLLIS Motsch.

Hab. Ovalau. Widely distributed throughout the tropics.

LISPINUS SPECULARIS Bernh. (SHARPI Cam.).

Hab. Taveuni. Also in the Malay Peninsula, Sumatra, Seychelles.

LISPINUS CASTANEUS Fauv.

Hab. Savu Savu, Taveuni, Viti Levu. Also in Java, New Guinea, Samoa, Seychelles, Australia.

LISPINUS SUBOPACUS Kr.

Hab. Viti Levu, Ovalau. Also in Ceylon, Sumatra, etc.

LISPINUS CURTICOLLIS Fauv.

Hab. Noumea.

OXYTELUS SEMIRUBER sp. nov.

Head and thorax ferruginous, subopaque, elytra and abdomen more shining, yellowish-brown, the base of the former and posterior margins of the segments lighter. Antennae with the first four joints testaceous, the rest blackish. Legs testaceous. Length, 1·8–2 mm.

♂ Near *O. raffrayi* Fauv., of the same opacity, but more brightly coloured, head of the same shape but narrower, antennal tubercles much more elevated, front more deeply excavated, the shining frontal impression narrower, eyes smaller, in the middle with an impressed line reaching from the polished frontal impression to the base, the curved postocular line scarcely visible, antennal tubercles and vertex entirely coriaceous, the sides of the vertex without oblique striae, postocular region irregularly wrinkled; antennae as in *O. raffrayi* but differently coloured; thorax less transverse, longer, and narrower, as broad as the head, the posterior angles broadly rounded, less coarsely rugulose, the dorsal sulci more defined; elytra more finely sculptured; abdomen yet more sparingly punctured. In female the head is narrower than in the female of *O. raffrayi*, scarcely as wide as the thorax, the frontal impression less shining, more or less wrinkled, eyes smaller, postocular line absent, vertex with median impressed line extending throughout, the whole surface coriaceous.

Hab. Taveuni. Five examples. Type, I. 16425.

SUB-FAMILY EVAESTHETINAE.

EDAPHUS SUMATRENSIS Schauf.

Hab. Viti Levu, Ovalau, Sumatra, Timor.

SUB-FAMILY PAEDERINAE.

PALAMINUS LATERALIS sp. nov.

Shining reddish-testaceous, the abdomen dark castaneous, the whole breadth of the reflexed margin of the elytra (except immediately below the shoulder and against the postero-external angle) black, each disc with an oval ill-defined brown spot in the middle, not extending to the suture on the lateral margin, occasionally absent. Antennae and legs pale yellow. Length, 5 mm.

A slender species, easily recognized by the black reflexed margin of the elytra. Head slightly broader than the thorax, the eyes very large, the whole surface with a rather large, close, and regular puncturation. Antennae with all the joints longer than broad, the third a little longer than the second, the eleventh longer than the tenth. Thorax a little transverse, the sides evenly rounded from base to apex, in the middle of the base with an impunctate keel and a short, narrow impression on either side of it, the puncturation not quite so coarse as that of the head. Elytra longer than broad, about half as long again as the thorax, rather coarsely and closely punctured. Abdomen with the usual imbricate sculpture, and the whole insect clothed with long, sparing, yellow pubescence.

Hab. Viti Levu, Type, I. 16427. Taveuni. Three examples.

PALAMINUS DIFFICILIS sp. nov.

Rufo-testaceous, abdomen castaneous. Antennae and legs pale testaceous. Length, 4 mm.

Closely allied to *P. pennifer* Fauv., of the same colour, but differing in the broader build of the head and thorax, the latter is shorter and broader, the median keel less pronounced, and both being more finely punctured; the elytra are longer and more coarsely rugulose.

Hab. Viti Levu, Type, I. 16427. Taveuni. Three examples.

PALAMINUS FIJIENSIS sp. nov.

Shining reddish-testaceous, the abdomen castaneous, the postocular region of the head, the side margins of the thorax, and the postero-external angles of the elytra black. Antennae and legs pale yellow. Length 3 mm.

A small, slender species, readily distinguished by the colouration. Head a little broader than the thorax, the eyes very large, the whole surface with rather large, close puncturation. Antennae slender, the third joint a little longer than

the second, fourth to seventh elongate of equal length, eighth and ninth shorter but distinctly longer than broad, tenth shorter and stouter than ninth, eleventh as long as the preceding. Thorax transverse, the sides evenly rounded and sharply and narrowly black, the epipleura testaceous; in the middle with an impunctate keel, extending from the base almost to the anterior border, and longitudinally impressed on either side, with a rather large and moderately close puncturation. Elytra broader than and about twice the length of the thorax, the postero-external angle with a black spot, which, however, does not extend on to the reflexed margin; sculpture rather coarse and transversely rugulose. Abdomen with the usual sculpture. Pubescence long and yellow.

Hab. Taveuni. Three examples. Type, I. 16428.

STILICOPSIS BREVICEPS Fauv.

Hab. Ovalau. Also in Malay Peninsula, Sumatra, etc.

OPHIOMEDON INCOMPTUS Shp.

Hab. Moturiki, Viti Levu, Hawaii.

ACANTHOGLOSSA QUADRATICEPS sp. nov. (Bernhauer *in litt.*)

Moderately shining, the head and thorax red, the elytra reddish-testaceous; abdomen brown, the posterior half of the fifth segment testaceous. Antennae and legs reddish-testaceous. Length, 3–3·5 mm.

Near *A. testaceipennis* Kr. Very similar in colour, but broader, the head larger, with less marked posterior angles, eyes a little larger, sculpture coarser, antennae a little longer, the penultimate joints less transverse, thorax broader, sculpture coarser and more or less longitudinally confluent, elytra more asperately punctured. Head as broad as thorax, quadrate, eyes small, sculpture close and umbilicate, with a tendency to confluence at the sides of the disc. Antennae with second and third joints subequal, fourth to seventh moniliform, ninth and tenth transverse. Thorax widest at the rounded anterior angles, the sides almost straight, and converging behind to the broadly rounded posterior angles, with or without a very fine, shining median line in the posterior half, sculpture umbilicate, and more or less longitudinally confluent on the disc. Elytra a little broader and longer than the thorax, longer than broad, rather finely, closely, asperately punctured, finely pubescent. Abdomen finely and rather closely punctured, with rather long, close, yellowish pubescence throughout.

Hab. Savu Savu, Type, I. 16429, Taveuni, Ovalau. Three examples. In the British Museum a specimen from Lautoka bearing the manuscript name of Bernhauer.

LITHOCHARIS VILIS Kr.

Hab. Taveuni. Widely distributed in the tropics.

CALLIDERMA INDICA Kr.

Hab. Viti Levu. Also in India.

SUB-FAMILY STAPHYLININAE.

METOPONCUS SEMIRUBER Fauv. var. ?.

Hab. Ovalau.

PACHYCORYNUS RUFOTESTACEUS sp nov.

Depressed, shining rufo-testaceous, elytra testaceous, more or less infuscate posteriorly. Antennae and legs testaceous. Length, 3–4·5 mm.

Much smaller and narrower than *P. dimidiatus* Motsch., but of similar build, the head and thorax much more closely and less finely punctured, the elytra more closely punctured. Head quadrate, a little longer than broad, the temples parallel, the posterior angles briefly rounded, the base truncate; median grooves short, parallel, much shorter than in *P. dimidiatus*, the lateral obsolete; the space between the frontal grooves and an area of equal width extending to the base, impunctate, the rest of the surface moderately coarsely punctured, the temples more finely but equally closely, the punctures umbilicate; ground sculpture distinct, more or less transverse and wavy. Antennae with third to tenth joints transverse, the penultimate ones three times broader than long. Thorax elongate, narrower than the head, widest at the rounded anterior angles, narrowed behind, the sides not sinuate; the whole of the surface, except for a moderately broad space extending the whole length in the middle and the anterior angles, moderately finely but not closely, somewhat serially punctured; the ground sculpture as on the head, but much less distinct. Elytra a little wider, but as long as the thorax, longer than broad, finely and rather closely punctured. Abdomen very finely and very sparingly punctured, with a fine transverse ground sculpture.

Hab. Viti Levu. Three examples. Type, I. 16430.

PACHYCORYNUS DELICATULUS sp. nov.

Very near *P. analis* Fauv. Of the same size and colour, and differing only in the following respects: The head is shorter, scarcely longer than broad, whereas in *analis* it is distinctly longer than broad and the puncturation is finer, the thorax more finely and less closely, the elytra very finely but less obsoletely punctured.

Hab. Ovalau, Taveuni, Moturiki, Viti Levu. Eleven examples, Type, I. 16430.

CTENANDROPUS NIGRICEPS Cam.

Hab. Moturiki, Taveuni. Four examples. Also in India and Sumatra.

CAFIUS NAUTICUS Fairm.

Hab. Wakaya, Noumea. Widely distributed on South Pacific and Indian littorals.

CAFIUS CORALLICOLA Fairm.

Hab. Yanuca Lili, Noumea. Widely distributed in South Pacific, Indian Ocean, and Red Sea.

SUB-FAMILY TACHYPORINAE.

COPROPORUS IMMATURUS Bernh.

Hab. Viti Levu. Widely distributed in the Oriental region.

COPROPORUS ALUTACEUS Fauv.

Hab. Taveuni, Savu Savu, Ovalau, Viti Levu, Moturiki. Numerous examples. Also in New Guinea, etc.

COPROPORUS CINCTIPENNIS Fauv.

Hab. Noumea.

SUB-FAMILY ALEOCHARINAE.

BRACHIDA DENSIVENTRIS sp. nov.

Near *B. crassiuscula* Kr. Similarly coloured, but smaller, the head narrower, thorax narrower and less punctured, elytra much more finely punctured, the abdomen finely and densely punctured. Antennae brown, the first three joints and the last testaceous, fifth to ninth joints longer than broad, gradually decreasing in length, tenth as long as broad. Length, 2·4–2·75 mm.

♂ Seventh dorsal segment with a tubercle in the middle line near the posterior margin; eighth narrowed, the posterior margin with a semilunar excision and a tubercle in the middle line on the margin.

Hab. Viti Levu. Three examples. Type, I. 16432.

BRACHIDA NIGRA sp. nov.

Minute, black, shining, the posterior border of the seventh and whole of the eighth abdominal segments obscure testaceous. Antennae testaceous, the last two joints blackish. Legs testaceous. Length, 1–1·3 mm.

Head finely and not closely punctured, finely pubescent. Antennae short, first and second joints subequal, third narrower and about half as long as second,

fourth to tenth transverse, gradually increasing in width, the penultimate about twice as broad as long, the eleventh short, oval, quite as long as the two preceding together. Thorax strongly transverse, widest behind at the obtuse posterior angles, the sides narrowed and rounded towards the front, the base finely margined and sinuate on either side, finely, asperately, but not very closely punctured, and with a stiff, rather coarse pubescence, the sides before the base with a seta. Elytra a little broader and longer than the thorax, transverse, rather less finely and more closely asperately punctured than the thorax, and with a similar pubescence, at the sides with three setae. Abdomen narrowed from base to apex, finely and not very closely punctured, and finely, sparingly pubescent, at the sides with a few setae.

♂ Suture of the elytra anteriorly with a small tubercle on either side; seventh dorsal segment with a keel in the middle line from the base to beyond the middle; eighth with a long, sharp, incurved spine on either side, in the middle with a shorter and more slender spine.

Hab. Viti Levu, Type, I. 16433. Moturiki. Two examples.

BRACHIDA ELEVATA Fauv.

Hab. Noumea.

STERNOTROPA BREVICORNIS sp. nov. (1).

Shining, black, the head in front and the disc of the elytra more or less reddish, abdomen scarcely reddish at the base, the apex obscurely testaceous. Antennae testaceous, the last joint infuscate. Legs testaceous. Length, 1·75 mm. (in extended examples).

Near *S. nigra* Cam., but a little longer, the puncturation of the thorax distinctly closer, the elytra much shorter and more sparingly punctured, abdomen less closely punctured. Head practically impunctate. Antennae with third joint shorter than second, fourth slightly longer than broad, fifth as long as broad, sixth to tenth transverse, slightly increasing in width, the penultimate joints about half as broad again as long, eleventh stout, oval, about as long as the two preceding together. Thorax strongly transverse, convex, widest a little behind the middle, the sides rounded, more narrowed in front than behind, the posterior angles rounded, finely, asperately, moderately closely punctured, with a fine decumbent pubescence. Elytra a little broader and as long as the thorax, strongly transverse, with a less fine puncturation than that of the thorax, asperate, and with a similar pubescence, on either side with three moderately strong outstanding setae. Abdomen gradually narrowed from base to apex, finely, moderately closely punctured and pubescent, and with a few longer black setae, the

(1) This genus is closely allied to *Brachida*, but is at once distinguished from it by the carinate mesosternum.

sides also with setae. The colour of the elytra is variable, sometimes entirely black, sometimes reddish with the sides infuscate.

♂ Eighth dorsal segment with a crescentic emargination.

Hab. Viti Levu, Type, I. 16434. Taveuni, Ovalau. Several examples.

STERNOTROPA LONGICORNIS sp. nov.

At once distinguished from the preceding by the longer antennae, but in other respects extremely similar. The antennae have the second and third joints elongate and equal, fourth to eighth distinctly longer than broad, gradually decreasing in length, ninth and tenth as long as broad, eleventh conical, as long as the two preceding together. In the male the emargination of the eighth dorsal segment is rather deeper.

Hab. Ovalau, Taveuni, Viti Levu. Type, I. 16485.

GYROPHAENA DISCOIDALIS Fauv.

Hab. Wakaya.

GYROPHAENA FIJIENSIS sp. nov.

Entirely black, shining. Thorax with four quadrately placed punctures. Antennae and legs testaceous. Length, 1–1·2 mm.

Very near *G. discoidalis* Fauv., but entirely black and of smaller size, the antennae not so stout, the sculpture of the elytra more sparing, the abdomen practically impunctate, the fifth and sixth segments without other sculpture than the usual fine coriaceous ground sculpture and the male characters ([2]). Head bipunctate in front, otherwise practically impunctate, and with scarcely visible ground sculpture. Antennae stout, the fourth to tenth joints transverse, the penultimate about twice as broad as long. Thorax with four fine quadrately placed punctures on the disc and a few very fine ones towards the sides; ground sculpture very indistinct. Elytra impressed laterally, and with a sparing scabrous sculpture, yet more sparing in the female. Abdomen less shining than the fore-parts, practically impunctate, and with a very fine coriaceous ground sculpture.

♂ Seventh dorsal segment before the posterior margin or either side of the middle line with a tubercle; eighth produced on either side into a broad triangular process with rounded apex, the outer border and apex thickened and upturned, the margin between the processes truncate.

Hab. Taveuni. Seven examples. Type, I. 16436.

([2]) In *G. discoidalis* Fauv., the male has the eighth dorsal segment narrowed and produced on either side into a short, stout, triangular, bluntly pointed process (somewhat as in *G. furcata* Motsch), the margin between truncate. The seventh segment without tubercles.

GYROPHAENA QUADRIPUNCTULA sp. nov.

Very near *G. quadra* Fauv.; of similar build, and with four quadrately placed punctures on the disc of thorax. The female, however, differs in the blacker colouration, the rather less sparing (but similar) sculpture of the elytra, and especially in the last three segments of the abdomen, having a fine, close, scabrous sculpture (in both sexes), whereas in *G. quadra* these segments are practically smooth.

♂ Elytra more coarsely sculptured; on either side of the suture anteriorly with a tubercle. Eighth dorsal segment on either side produced into a stout, pointed process, the outer margin of which is curved and the inner straight (much as in *G. furcata* Motsch.), the narrow posterior margin of the segment between the processes truncate.

Hab. Viti Levu, Wakaya. Three examples.. Type, I. 16435.

DIESTOTA ALTERNANS sp. nov.

♀ Greasy lustrous; head black, thorax and abdomen reddish; the fourth (visible) segment black; elytra pitchy narrowly rufescent at the base. Antennae blackish, the first three joints and apex of the last testaceous. Legs testaceous. Length, 2·2 mm.

Smaller, narrower, and less shining than *D. testacea* Kr., with less thickened antennae, much more closely punctured head and thorax, and finely, closely, and asperately punctured elytra and rather more finely punctured abdomen. Head finely and rather closely punctured. Antennae with third joint a little shorter than second, fourth as long as broad, fifth to tenth transverse, the penultimate joints about half as broad again as long, eleventh conical, as long as the two preceding together. Thorax widest at the middle, the sides evenly rounded and a little more narrowed behind than in front, the posterior angles obtuse, in the middle before the base with a small fovea; puncturation similar to that of the head, but rather closer, finely pubescent. Elytra a little longer and broader than the thorax, scarcely transverse, finely, closely, and asperately punctured, finely pubescent. Abdomen finely and rather closely punctured in front, more sparingly behind, finely pubescent.

Hab. Viti Levu. Three examples. Type, I. 16437.

APHELOGLOSSA INSULARIS sp. nov.

♀ Of the build and colour of *Diestota testacea* Kr., but narrower, the prosternum without a keel, the antennae shorter and less thickened but similarly constructed, the head and thorax more finely punctured, the latter on either side of the median fovea with a row of larger punctures curved outwards and forwards before the basal margin, the elytra are a little more closely punctured, and

in addition along the suture and on the posterior part of the disc are a few larger punctures. The abdominal segments at the base similarly coarsely punctured to *D. testacea*, but the rest of the surface obviously more closely punctured, the eighth segment closely and asperately. Length, 2·75 mm.

Hab. Ovalau, Type, I. 16438. Viti Levu. Two examples.

APHELOGLOSSA PACIFICA sp. nov.

Reddish, a little shining, with distinct yellow pubescence, the elytra largely infuscate on the disc; abdomen more shining, the fourth segment often infuscate. Antennae blackish, the first three joints and apex of the last testaceous. Legs testaceous. Length, 2 mm.

Head broad but narrower than the thorax, rather coarsely, closely, and deeply punctured. Antennae short, scarcely reaching the posterior angles of the thorax, second and third joints subequal, fourth to tenth transverse, gradually increasing in width, the penultimate about three times as broad as long. Thorax strongly transverse, widest a little before the obtuse posterior angles, the sides rounded, more narrowed in front than behind, the base sinuate on either side and broadly produced backwards in the middle, with a small transverse depression, from which emerge a pair of very obsolete diverging impressions, within the posterior angles obliquely impressed, the whole surface with a fine, close, granular sculpture. Elytra a little longer and broader than the thorax, transverse, with a superficial but rather large and close puncturation. Abdomen finely and moderately closely punctured in front, more sparingly behind, finely pubescent, and with some longer black setae, the sides distinctly setiferous.

Hab. Taveuni, Type, I. 16439. Savu Savu, Viti Levu. Eleven examples.

PSEUDOPHAENA LUCIDA sp. nov.

Very shining; head brownish-red, thorax black, elytra and abdomen pitchy-black. Antennae blackish, the first three joints testaceous. Legs testaceous. Length, 2 mm.

A shining, rather robust species, differing from *P. castanea* Cam. in the larger and more robust build, longer and thinner antennae, and almost impunctate thorax. Head extremely finely, and very sparingly punctured, narrower than the thorax. Antennae extending to the posterior angles of the thorax, the third joint shorter than the second, fourth, fifth, and sixth about as long as broad, seventh to tenth transverse, the latter about twice as broad as long. Thorax strongly transverse, widest a little behind the anterior angles, the sides rounded in front, more narrowed and almost straight to the obtuse posterior angles, before the scutellum with a deep transverse impression, from which arises on either side a short diverging sulcus; the puncturation is extremely fine and very sparing.

Elytra distinctly broader and a little longer than the thorax, transverse, the sides rounded, with a rather coarse but not very close puncturation. Abdomen at the bases of the anterior segments with a transverse row of rather coarse punctures; elsewhere very finely and very sparingly punctured.

♂ Eighth dorsal segment on either side with a slender spine, between those with four small teeth; on either side of the middle before the posterior margin with a fine keel.

Hab. Ovalau. Two examples. Type, I. 16440.

HETAIROTERMES LEAI sp. nov.

Head, thorax, and elytra shining black, abdomen less shining, pitchy, the apex brownish-testaceous. Antennae and legs testaceous. Length, 2·3 mm.

Near *H. latebricola* Lea, but differently coloured, the thorax longer and less transverse, the sides straighter, and antennae longer. Head much narrower than the thorax, on either side of the disc with five or six moderate punctures, otherwise impunctate and glabrous. Antennae pointed, the joints oblong and compressed. Thorax about one-fourth broader than long, convex, the sides nearly straight, and gradually narrowed from the rounded posterior to the rounded anterior angles, with fine, very sparing punctures, each with a short, erect, black seta. Elytra slightly narrower and much shorter than the thorax, strongly transverse, with a similar setiferous puncturation to that of the thorax. Abdomen gradually pointed from base to apex, with an exceedingly fine and close puncturation, very finely and shortly pubescent, with a few long setae.

Hab. Taveuni. Four examples with a termite. Type, I. 16441.

CHELDOPHILA ANNULARIS Cam.

Hab. Viti Levu, Taveuni, Ovalau.

HOMALOTA ANGULARIS sp. nov.

Black, greasy lustrous, the elytra testaceous, with the postero-external angles infuscate; abdomen brown, the fourth (visible) segment black. Antennae black, the first two joints reddish-testaceous. Legs testaceous. Length, 3 mm.

Scarcely differing in size, build, and colour from *H. cribrum* Fauv. (*denticulata* Cam.), but the antennae are shorter and rather less thick, the thorax is without puncturation, but similarly coriaceous, the puncturation of the elytra a little less close, the abdomen is very much less densely punctured.

♂ Eighth dorsal segment with the posterior margin gently rounded, and furnished in the middle with a short, blunt tooth.

Hab. Ovalau. Two examples. Type, I. 16442.

ANOMOGNATHUS DEBILIS sp. nov.

Linear, parallel, scarcely shining, the head and elytra pitchy-black, the thorax and abdomen reddish-brown, the fourth (visible) segment blackish. Antennae black, the first two joints brownish-testaceous. Legs testaceous. Length, 1·75 mm.

A little larger than *A. brunneicollis* Cam. Very similar in build and colour, but much less shining, the head more finely punctured, the antennae a little longer and different male characters. Head quadrate, the eyes rather large and moderately prominent, the temples rather longer, their posterior angles briefly rounded, rather finely, superficially, and rather closely punctured except in front, and with distinct coriaceous ground sculpture. Antennae with the third joint shorter than the second, fourth to tenth transverse, the penultimate fully three times broader than long. Thorax a little wider than the head, slightly transverse, widest a little before the middle, the sides feebly rounded and narrowed to the anterior angles, more strongly and more straightly narrowed behind to the rounded posterior angles; in the middle longitudinally impressed, scarcely punctured, but very distinctly coriaceous. Elytra as long as but broader than the thorax, as long as broad, very indistinctly punctured, but distinctly coriaceous, like the thorax. Abdomen longer than the fore-parts, very finely, moderately closely punctured, finely pubescent.

♂ Eighth dorsal segment with three equal teeth, the lateral ones separated from the median on either side by a deep rounded excision.

♀ Eighth dorsal segment with a stout tooth on either side, truncate between the teeth.

Hab. Taveuni, Type, I. 16443. Ovalau, Savu Savu.

SILUSA (s.str.) BIPLAGIATA sp. nov.

Scarcely shining, the head and thorax brown, with lateral margins narrowly rufescent; elytra blackish, the base more or less broadly, the suture and apical margin reddish; abdomen black, the apex obscurely pitchy-testaceous. Antennae with the first two and the last joints testaceous. Legs testaceous. Length, 2·75 mm.

Var. Uniformly reddish-ochraceous, the elytra more or less infuscate posteriorly.

Head finely and closely punctured, finely pubescent. Antennae with second and third joints subequal, fourth as long as broad, fifth to tenth transverse, gradually increasing in breadth, the penultimate joints about twice as broad as long, the eleventh conical, longer than the two preceding together. Thorax strongly transverse, widest about the middle, the sides evenly rounded but more

narrowed in front, the posterior angles obtuse; before the scutellum with a short transverse impression, finely and closely punctured and pubescent like the head. Elytra a little longer and broader than the thorax, transverse, finely, closely, asperately punctured and finely pubescent. Abdomen rather coarsely punctured at the bases of the segments, more finely elsewhere, the seventh segment scarcely more sparingly than the preceding, pubescence rather long and stiff, especially at the sides.

♂ Seventh dorsal segment with a tubercle on the posterior border in the middle; eighth feebly, broadly emarginate, and furnished with about six small, blunt teeth, which are continuous with six small keels; in the middle with a tubercle.

Hab. Viti Levu (Type and variety), Ovalau. Several examples. Type, I. 16444.

TACHYUSA INSULANA Fairm.

Hab. Viti Levu, Wakaya, Moturiki, Taveuni, Ovalau. Also in Samoa.

ATHETA (METAXYA) FIJIANA sp. nov.

Black, shining, elytra pitchy, with the base and apical margin rufescent. Antennae black, the first three joints testaceous. Legs testaceous. Length, 3 mm.

In facies resembling *Gnypeta caerulea* Sahlb. Head broad, but narrower than the thorax, very finely and moderately closely punctured, more sparingly in front. Antennae long and slender, reaching a little beyond the base of the elytra, the third joint distinctly longer than the second, fourth to ninth all distinctly longer than broad, gradually decreasing in length, tenth as long as broad, eleventh as long as the two preceding together. Thorax slightly transverse, widest before the middle, the sides rounded in front, more narrowed and sinuate behind, the posterior angles obtuse, very finely and rather closely punctured. Elytra scarcely as long as but a little broader than the thorax, transverse, more finely and rather more closely punctured. Abdomen very finely and rather sparingly punctured on the first three segments, yet more sparingly on the following, with a stiff and scanty pubesence.

Hab. Viti Levu, Type, I. 16445. Ovalau. Several examples.

ATHETA (s.str.) BICINCTA sp. nov.

Fore-parts greasy-shining, abdomen shining. Head black; thorax red; elytra pitchy, scarcely rufescent at the shoulders; abdomen red, the third, fourth, and base of the fifth (visible) segments black. Antennae brown, the first two joints testaceous. Legs testaceous. Length, 2·75 mm.

About the size and build of *A. coriaria* Kr., but with broader head. Head

transverse, rather large, finely and rather closely punctured, and finely pubescent. Antennae with the third joint scarcely longer than the second, fourth very slightly longer than broad, fifth as long as broad, sixth to tenth transverse, the penultimate about one and a half times broader than long, eleventh conical, longer than the two preceding together. Thorax strongly transverse, widest about the middle, the sides evenly rounded, the posterior angles rounded; in the middle before the base with an impressed line, very finely and rather closely punctured, finely pubescent. Elytra scarcely longer, but a little broader than the thorax, transverse, less finely and rather more closely punctured than the thorax, finely pubescent. Abdomen very slightly narrowed towards the apex, the first three segments very finely and rather sparingly punctured and pubescent, the following yet more sparingly.

♂ Eighth dorsal segment on either side with a long, slender spine, the margin between crenulate, and separated from the spine by a rounded emargination.

Hab. Wakaya. Two examples. Type, I. 16446.

THAMIARAEA INSIGNIVENTRIS Fauv. (MIRIVENTRIS Cam.).

Hab. Moturiki. Widely distributed in the Oriental region.

PARACYPHEA (3) NOUMEANA sp. nov.

Fore-parts greasy-shining, brownish-red, elytra pitchy, obscurely lighter at the base; abdomen shining black, the first two (visible) segments reddish, the posterior half of the fifth and whole of the sixth reddish-testaceous. Antennae pitchy, the first three joints testaceous. Legs testaceous. Length, 2 mm.

Head narrower than the thorax, finely and closely punctured and pubescent. Antennae with the third joint shorter than second, fourth as long as broad, fifth to tenth transverse, the penultimate twice as broad as long, the eleventh stout, oval, larger than the two preceding together. Thorax strongly transverse, widest at the middle, the sides evenly rounded and equally narrowed in front and behind, finely bordered, the posterior angles rounded, the base finely bordered, very finely and rather closely punctured and pubescent. Elytra longer, but as broad as the thorax, very slightly transverse, the puncturation slightly less fine, but as close as that of the thorax. Abdomen a little narrowed towards the apex, the first three segments very finely but not very closely punctured, the following yet more sparingly.

♂ Eighth dorsal segment with three equal triangular teeth, separated from each other by a rounded emargination.

Hab. Noumea. Three examples. Type, I. 16447.

(3) So far as can be seen without a complete dissection, this insect appears to have the structure of the genus *Paracyphea*.

DESCRIPTIONS OF NEW STAPHYLINIDAE FROM FIJI

BY ARTHUR M. LEA, F.E.S., ENTOMOLOGIST, SOUTH AUSTRALIAN MUSEUM

Summary

In addition to the Staphylinidae dealt with by Dr. Cameron in the preceding paper, a few species represented by single specimens were examined by him and returned as new; the more distinct ones are described herein.

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TETRAPLEURUS SEMIOPACUS sp. nov.

Of a rusty red and opaque, but abdomen shining.

Head with two large but shallow depressions. Eyes prominent. Antennae not very long, three or four apical joints forming a loose club. Prothorax slightly wider than long, slightly wider than head across eyes, parallel-sided to basal third and then strongly narrowed to base, which is about half the width of apex; with three longitudinal depressions, of which the median one occupies about one-third of the width, and is divided into two parts by a curved ridge, each lateral depression also interrupted in middle. Elytra slightly longer than wide, and slightly wider than prothorax, sides parallel; with six regular ridges on each, alternating with deep grooves. Length, 1·75 mm.

Hab. Taveuni. Type, I. 16455.

Dr. Cameron returned the type as a new species of *Tetrapleurus* (1). In general appearance it is much like a small form of two Australian species of *Thoracophorus (sculptus* and *myrmecophilus,* originally referred to *Glyptoma).* The abdomen, antennae, and legs are of much the same colour as the other parts, but as the latter are opaque they appear differently coloured. Under a compound power the opaque parts appear to be rather coarsely shagreened or granulate-punctate, and even the abdomen to be finely reticulate.

PALAMINUS TRIVITTIPENNIS sp. nov.

Pale reddish-castaneous, abdomen, except at apex, somewhat darker, antennae, palpi, and legs flavous; sides of prothorax, sides and suture of elytra with narrow blackish vittae. Moderately clothed with whitish pubescence, longer on abdomen than elsewhere.

Head rather strongly convex, with strong punctures. Prothorax about as long as the apical width, sides rounded and diminishing in width to base, with a median ridge on basal half; punctures more crowded than on head. Elytra considerably longer than wide, sides gently rounded, punctures more even than

(1) Bernhauer, Verh. z. b. Ges. Wien, 1914.

on pronotum. Abdomen more than half the total length; four basal segments and part of the next with the usual granulate-reticulate sculpture, apex with two long spines and a shorter median one. Length, 4·5 mm.

Hab. Taveuni. Type, I. 16481.

About the size of *P. difficilis*, but prothorax and elytra with conspicuous, although narrow, markings. *P. vitiensis* appears to be a slightly larger species, with darker abdomen, and with markings on head and middle of pronotum.

SCOPAEUS MYRMECOCEPHALUS sp. nov.

Dull reddish-castaneous, legs slightly paler, basal half of abdomen, except tips and sides of the segments, deeply infuscated on upper surface. Rather densely clothed with very short, depressed pubescence.

Head longer than wide, sides gently rounded behind the eyes, base evenly incurved to middle. Antennae extending almost to base of prothorax, second to tenth joints moniliform. Prothorax distinctly narrower than head, widest near apex, and then strongly narrowed to apex itself. Elytra about one-fourth longer than wide, slightly longer and distinctly wider than prothorax. Length, 2·5 mm.

Hab. Yanuca Lili. Type, I. 16460.

In general appearance close to the Australian *S. ovicollis*, but larger, and apex of elytra and basal half of abdomen differently coloured. *S. flavocastaneus*, also from Australia, is larger and more uniformly coloured. The apex of the elytra is very little paler than the preceding parts, and the two shades are not sharply limited. The shape of the head strongly resembles that of many small ants of the genus *Irodomyrmex*. The whole of the upper surface is finely shagreened.

METOPONCUS HOPLOCEPHALUS sp. nov.

Head, prothorax, scutellum, and antennae of a rather dingy red, tarsi paler, elsewhere deep black, the elytra with a slight bluish gloss. A few hairs on the sides becoming longer about the apex of abdomen.

Head (including mandibles) about twice as long as wide, moderately convex, sides parallel from antennae to basal angles, which are rounded off; with four short oblique grooves in front, the inner ones very short, and between them a thin, conspicuous projection about half the length of the basal joint of antennae, and truncated at apex; punctures small in front, becoming smaller and sparser posteriorly. Antennae scarcely extending to base of head, most of the joints strongly transverse. Prothorax almost as long as head, and in front almost as wide, punctures sparse and mostly small. Elytra slightly longer and wider than head, almost impunctate. Length, 7·5 mm.

Hab. Viti Levu, in July. Type, I. 16463.

Readily distinguished from all other species known to me by the armed head; in general appearance it is close to *M. semiruber,* but the elytra and abdomen are entirely dark.

METOPONCUS PLATYCEPHALUS sp. nov.

Black, abdomen and tarsi reddish-flavous, antennae and palpi more reddish. With sparse hairs scattered about, becoming longer on sides, and more numerous at apex of abdomen than elsewhere.

Head very flat, distinctly longer than wide, angles rounded off; with two short oblique grooves on each side in front, and with a faint median line; punctures numerous but not crowded, and rather coarse, with a tendency to become longitudinal. Antennae rather stout, just extending to apex of prothorax. Prothorax slightly shorter and narrower than head, widest near apex, all angles rounded off; with an impunctate median line, bounded on each side by a row of distinct punctures, near each side an irregular row of punctures, and a few irregularly scattered. Elytra about as long and as wide as head, sutural striae well defined; with fairly numerous well-defined punctures, becoming small on sides. Abdomen with sparse, distinct punctures. Length, 7·5 mm.

Hab. Viti Levu, in July. Type, I. 16464.

Readily distinguished from *M. semiruber* by the wider and very flat head, with very different punctures. Each puncture of the upper surface contains an erect seta or hair.

METOPONCUS ERYTHROCEPHALUS sp. nov.

Black, head, antennae, palpi, and tarsi reddish, basal two-fifths of elytra flavous. With a few marginal hairs, becoming more numerous about apex of abdomen.

Head flat, almost twice as long (including mandibles) as wide, parallel-sided behind antennae, hind angles rounded off, neck very narrow; with a fairly long and oblique groove on each side in front, and a shorter and straight one behind each antenna; with numerous small punctures, and very finely strigose. Antennae just extending to prothorax. Prothorax shorter and narrower than head, widest near apex, all angles rounded off; with four punctures of moderate size in pairs, and numerous minute ones. Elytra slightly longer and wider than prothorax, with remnants of sutural striae only near base; punctures sparse and ill-defined. Abdomen almost impunctate. Length, 5·5 mm.

Hab. Viti Levu. Type, I. 16465.

Considerably smaller than all the other Fijian species, and very differently

coloured; the head is not quite as flat as in the preceding species, and its punctures are very different. At first glance the head appears to have a few small punctures only, but on close examination in certain lights its whole surface is seen to be very finely strigose. The flavous part of the elytra is somewhat triangularly advanced about the suture; the prothorax at first appears to be as black as the abdomen, but in some lights its front part is seen to be slightly diluted with red.

PACHYCORYNUS PALLIDUS sp. nov.

Pale flavo-castaneous, apical half of elytra infuscated. A few short hairs or setae scattered about, and becoming longer at tip of abdomen.

Head rather large and flat, excluding the jaws about one-fourth longer than wide; a small fovea touching each eye; two short medio-frontal grooves; punctures numerous but not crowded, of moderate size, and sharply defined. Antennae about as long as the head, including mandibles, most of the joints transverse. Prothorax distinctly longer than wide, apex almost semicircularly rounded; punctures sharply defined, but smaller and sparser than on head, and absent from a rather narrow median line. Elytra slightly longer and wider than prothorax, almost parallel-sided; a distinct stria on each side of suture; punctures slightly more numerous than on head, but smaller and less sharply defined. Abdomen with five basal segments almost parallel-sided. Legs rather short and stout. Length, 3·5 mm.

Hab. Viti Levu. Type, I. 16466.

The abdomen and femora are somewhat paler than the head, but even this is not very dark. The head has a median impunctate line, which in front appears as a slight ridge between the frontal grooves.

COPROPORUS MORULUS sp. nov.

Black; muzzle three apical segments of abdomen, and legs of a rather dingy brownish-flavous, antennae somewhat darker, apex of elytra obscurely reddish. Sides of abdomen sparsely setose.

Head with a few inconspicuous punctures. Antennae about as long as the prothorax is wide. Prothorax fully twice as wide as long, base much wider than apex, outlines continuous with those of head and elytra; almost impunctate. Elytra slightly longer than the apical width, and shorter than the basal; punctures minute but fairly dense. Abdomen with five strong apical spines. Length, 1·75 mm.

Hab. Ovalau, in June. Type, I. 16473.

A strongly convex species, structurally near *C. cinctipennis*, but prothorax

black; the colours are much as in *C. alutaceus*, but that is a smaller and much flatter species. About one-third of the elytra is obscurely diluted with red, but the shades are not sharply limited, and even the tip from some directions appears almost black. The abdomen of the type is much contracted.

LEUCOCRASPEDUM CRYPTOCEPHALUM sp. nov.

Dark piceous-brown, head, sides, and apex of prothorax, tips of abdominal segments (the two apical ones more widely than the others), and legs paler, antennae still paler, the apical joint slightly infuscated. Densely clothed with short, depressed pubescence, the sides of the abdomen with numerous black setae or bristles, becoming longer and more numerous about apex.

Prothorax semicircular, twice as wide as long, hind angles slightly clasping elytra, punctures scarcely visible. Elytra slightly longer than prothorax along middle, and their outlines continuous with those of that segment, apex gently incurved to middle; with crowded and small punctures. Abdomen about three-fifths the total length, punctures much as on elytra. Length, 2 mm.

Hab. Viti Levu. Type, I. 16475.

In general appearance very close to the Australian *L. sidniense* (some specimens of which have the body parts similarly coloured), but antennae thinner (thinner than on all the described Australian species), only the eleventh joint infuscated, and that but slightly, and abdomen with longer setae. The head is completely covered by the prothorax, but as the apex of the latter is semi-transparent, part of it is vaguely traceable from above. The prothorax and elytra, except that the latter are more abbreviated, are strongly suggestive of *Sericoderus* of the Corylophidae.

DIGLOTTA MARITIMA sp. nov.

Of a dingy brownish-flavous, legs paler, most of fourth segment of abdomen blackish. With very short, depressed whitish pubescence.

Head with hind angles rounded off. Eyes small and lateral. Antennae almost extending to base of prothorax, second joint slightly shorter than first, distinctly longer than eleventh, and about twice the length of each of the others. Prothorax slightly transverse, almost parallel-sided. Elytra distinctly transverse, and distinctly shorter than prothorax. Length, 2 mm.

Hab. Levuka. Type, I. 16476.

A small, depressed, dingy species, the only specimen of which was taken under a stone well below high tide; the base of its head was crushed at the time of capture, and there is a median depression on the pronotum, which is probably

also accidental. The head is slightly wider than the prothorax, and about the width of the abdomen near the apex (where it is slightly wider than elsewhere), but at first glance the insect appears (except for its extremities) parallel-sided throughout. Under a compound power the whole of the upper surface appears finely shagreened.

ON A NEW GENUS OF WATER BEETLES (DYTISCIDAE)

BY ARTHUR M. LEA, F.E.S., ENTOMOLOGIST, SOUTH AUSTRALIAN MUSEUM

Summary

During a recent visit of Australian ornithologists and other naturalists to Dungog, in New South Wales, Mr. Charles Barrett obtained some small and singularly interesting water beetles. They have sharply-defined pairs of geminate striae on the elytra, such as are common on many Melolonthides of the scarabaeidae, but an approach to a structure of a similar nature does not appear to be known in water beetles from any part of the world. In many characters, however, they are allied to Antiporus. Subsequently specimens were obtained from Mr. H. J. Carter and Mr. John Hopson. Two species were taken, readily distinguished, inter se, by the front tibiae of the males and by the spots on the elytra. They were obtained when searching for Dryopidae, and of them Mr. Hopson wrote: "The eight-spotted ones are rather plentiful in the cracks of wood lying in still water; the four-spotted ones are not so plentiful".

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Text fig. 106.

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BARRETTHYDRUS gen. nov.

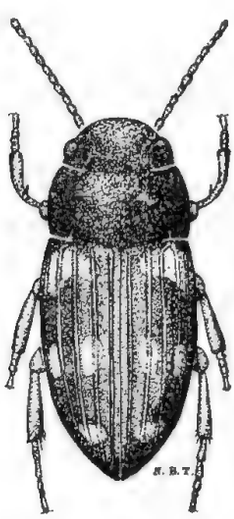

Fig. 106. *B. geminatus.* × 10.

Each elytron with five pairs of geminate striae.

This character alone is sufficient to distinguish the genus from all others recorded from Australasia, and all of those described or figured by Sharp. The under parts approach those of *Necterosoma* and *Antiporus*, near which the genus should be placed. From the former (apart from the elytra) it is distinct by the fourth tarsal joint of the front legs not passing beyond the lobes of the third, although fairly distinct, despite its minute size; the claw joint is also decidedly shorter. The tarsi are much like those of *Antiporus*. The short basal striae of the pronotum, the intercoxal process of the prosternum and other parts of the under-surface denote an approach to *Bidessus*.

Type of genus, *B. geminatus*.

BARRETTHYDRUS GEMINATUS sp. nov.

♂ Black, shining; antennae, palpi, tarsi, knees, and trochanters reddish; elytra with three series of flavous spots.

Head with crowded small punctures, with two feeble oblique impressions ending in shallow impressions near eyes. Antennae thin, extending to about middle of metasternum. Prothorax more than thrice as wide as long, sides finely margined; with dense punctures, somewhat larger than on head, and usually sharply defined, but becoming irregular about base. Elytra widest at about basal fourth, each with five well-defined pairs of geminate striae, punctures crowded and small, only sharply defined near sides: epipleurae sharply defined. Prosternum with a narrow, lanceolate intercoxal process, shallowly depressed along its middle, and meeting a raised prosternal process. Legs moderately long, front tibiae moderately curved, with a small tooth at the basal third, middle pair rather wide, bisinuate on lower edge; front tarsi with three basal joints inflated, fourth minute, fifth almost as long as first and second combined; hind tarsi with joints regularly decreasing in length, but the fifth almost twice the length of the fourth. Length, 3–3·25 mm.

♀ Differs in being slightly more robust, front tibiae simple, middle tibiae thinner, and tarsi not dilated.

Hab. New South Wales: Dungog in October (C. Barrett and H. J. Carter); Allyn River (H. J. Carter and J. Hopson).

On the elytra the markings consist of an irregular basal fascia, interrupted before the suture, and not touching the sides, a series of four rather small postmedian spots each usually longer than wide, and two subapical spots somewhat larger than the postmedian ones. The tip of the abdomen is usually obscurely reddish. On the base of the prothorax the punctures are irregular, and at one-third from each side there is a feeble basal stria, fairly well defined on some specimens, scarcely traceable on others, many of the adjacent punctures are more or less longitudinally confluent. The under-surface has a shagreened appearance, owing to the small size, and crowded and irregular punctures. The tooth of the front tibiae of the male is small and acute, but being at the position where the incurvature is strongest, is concealed from most directions.

BARRETTHYDRUS TIBIALIS sp. nov.

♂ Black; antennae, palpi, most of legs, and tip of abdomen reddish, elytra with four flavous spots.

Head with several feeble impressions. Prothorax with crowded punctures becoming longitudinally confluent about base, with a moderately distinct basal stria slightly nearer each side than the middle. Elytra with five pairs of geminate striae. Front tibiae suddenly bent (almost at right angles) in middle, where there is a deep notch, bounded by a strong tooth; front tarsi moderately dilated; middle tibiae rather wide and flat, except close to base. Length, 3·5 mm.

♀ Differs in having front tibiae simple, the middle pair less dilated, and all the tarsi thinner.

Hab. New South Wales: Allyn River at Eccleston (H. J. Carter and J. Hopson).

In general appearance much like the preceding species, and with very similar punctures, antennae, and under-surface, but somewhat narrower, and with different front legs, etc. Of the elytral striae the first and second pairs are conjoined near apex, also the third and fifth, but of these the fifth pair vanish before the middle; on the preceding species the fifth is well defined throughout, except that it is rather weak posteriorly. Of the elytral spots there are two large humeral ones; the others are about half their size, and placed at the apical third, midway between the suture and sides, their positions being intermediate between the postmedian and subapical spots of the preceding species. The middle tibiae are more flattened and less bisinuate on the lower surface, and the front tarsi are less dilated.

ON SOME SAWFLIES FROM THE AUSTRALIAN REGION (HYMENOPTERA TENTHRIDINIDAE)

BY DR. RUNAR FORSIUS, FREDRIKSBERG (FINLAND)

Summary

This paper begins with a general view of the Sawflies belonging to the South Australian Museum, Adelaide, and, in addition, descriptions of some new or little known species in the collection of the same Museum are given. The material upon which the paper is based was submitted to me for study by the kindness of Mr. Edgar R. Waite, Director of the Museum. All the types of the new species have been returned to that institution.

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The genera and species treated in this paper are mainly arranged according to Rohwer's (6) proposed classification of the group.

The Australian fauna, though very interesting, is so far only incompletely known. It is therefore to be hoped that Australian entomologists, especially collectors in the western and central districts, will in future collect more material of this group. The author of this paper will be only too pleased to work on other collections from the Australian regions.

A LIST OF THE TENTHREDINOIDEA IN THE SOUTH AUSTRALIAN MUSEUM, AND THEIR LOCALITIES.

Family XIPHYDRIDAE.

Xiphydria leai sp. nov. Queensland: Cairns district.

Family ARGIDAE.

Trichorhachus australis Westw. W. Aust.: Capel River (W. D. Dodd).

Family TENTHREDINIDAE.

Caliroa limacina Retz. Tasm.: Hobart and Launceston.

Family PERREYIDAE.

Philomastix macleayi Westw. N.S. Wales: Dorrigo (W. Heron).
P. nancarrowi Frogg. N.S. Wales: Dorrigo (W. Heron).

FAMILY PTERYGOPHORIDAE.

Pterygophorus uniformis Kirby. N.S. Wales: Clarence River (A. and F. R. Zietz).

P. analis Costa. Tasm.: Launceston; S. Aust.: (F. R. Zietz), Balhannah (E. Guest).

P. cygnus Kirby. N.S. Wales: Clarence Rives (A. and F. R. Zietz).

P. cyaneus Leach. Queensl.: Bowen (A. Simson); N.S. Wales: Sydney (A. M. Lea), Wentworth (Miss Cushman), Cook's River; S. Aust.

P. interruptus Klug. S. Aust.: Lucindale (F. Secker and B. A. Feuerheerdt), Victor Harbour, Adelaide (J. G. O. Tepper), Keith, Tintinara (G. Farraud), Bull Island; N.S. Wales: Lindfield, Galston (D. Dumbrell), Sydney (A. M. Lea), Colo Vale (W. W. Froggatt), Wentworth Falls (A. Simson); Tasm. (A. Simson), St. Helens (F. M. Littler); N. Queensl. (Blackburn's collection).

P. cinctus Klug. Tasm.: Kelso, Launceston; N.S. Wales: Sydney, Lawson, Hurstville, Eden.

P. cinctus, var. **insignis** Kirby. Queensl.: Rockhampton (A. M. Lea), Brisbane (R. Illidge); Tasm. (A. Simson).

Phylacteophaga eucalypti Frogg. N.S. Wales: Sydney, bred from eucalyptus leaves (W. B. Gurney).

Diphamorphos apicalis sp. nov. S. Aust.: Mount Lofty, Adelaide.

Polyclonus atratus Kirby. Queensl.: Mount Tambourine.

Eurys laetus Westw. Tasm.: (A. Simson); S. Aust. (Rev. A. P. Burgess); Vict.: Mount Buffalo (Rev. T. Blackburn).

Neoeurys caudatus Morice. Tasm.: Cradle Mountain (H. J. Carter and A. M. Lea).

N. tasmanicus Roh. Tasm.: Cradle Mountain (H. J. Carter and A. M. Lea).

N. ventralis sp. nov. Tasm.: Cradle Mountain.

N. scutellaris sp. nov.: Tasm.: Hobart.

N. affinis sp. nov.: S. Aust.: Port Lincoln.

N. leai sp. nov.: S. Aust.: Ooldea.

N. pusillus sp. nov.: S. Aust.: Mount Lofty Ranges.

N. sp. nov. ?. S. Aust.: Kangaroo Island (J. G. O. Tepper).

N. sp. nov. ?. Tasm.: Swansea (A. M. Lea).

Clarissa carbonaria sp. nov. N.S. Wales: Forest Reefs.

C. variabilis sp. nov.; S. Aust.: Mount Lofty; Queensl.: Brisbane.

C. variabilis var. **collaris** nov.: S. Aust.: Melrose and Kangaroo Island.

C. variabilis var. **obscurus** nov. S. Aust.: Melrose.

FAMILY PERGIDAE.

Cerealces scutellata Kirby. S. Aust.: Adelaide; N.S. Wales: Sydney.

Perga dorsalis Leach. S. Aust.: Mount Lofty, Blakiston, Nairne, Adelaide, Reynella; Tasm.; N.S. Wales: Blue Mountains, Sydney.

P. schiodtei Westw. W. Aust.: Warren River.

P. kirbii Leach. S. Aust.; N.S. Wales: Sydney.

P. brevitarsis Morice. S. Aust.: Yeelanna, Ardrossan (J. G. O. Tepper), Dowlingville (— Willis); W. Aust.: Beverley (F. H. du Boulay), Badgebup.

P. brevipes sp. nov. S. Aust.: Yeelanna, Kangaroo Island.

P. polita Leach. S. Aust.: Balhannah (E. Guest), Adelaide, Darke's Peak, Nairne, Mount Lofty Ranges (S. H. Curnow), Maclaren Vale (Miss Morgan), Roseworthy (A. Rohin); Queensl.: Coen River (W. D. Dodd), Bowen (A. Simson).

P. castanea Kirby. N.S. Wales: Wentworth Falls.

P. esenbecki Westw. W. Aust.: Beverley (E. F. du Boulay), Badgebup.

P. mayrii Westw. Queensl.: Bowen (A. Simson).

P. lucida Roh. S. Aust. (Rev. A. P. Burgess); W. Aust.: Beverley (E. F. du Boulay).

P. moricei sp. nov. W. Aust.: Boulder.

P. cressoni Westw. W. Aust.: Beverley (E. F. du Boulay), Badgebup; S. Aust.: On mallee.

P. christii Westw. W. Aust.: Boulder (A. Bethune).

P. waitei sp. nov. S. Aust.: Murray River.

P. guerinii Westw. N.S. Wales: Wentworth Falls; S. Aust.: Kangaroo Island (J. G. O. Tepper).

P. ferruginea Leach. N.S. Wales: Sydney (A. M. Lea).

P. latreillei Leach. S. Aust.: Lucindale (B. A. Feuerheerdt).

P. bella Newm. S. Aust. (Rev. A. P. Burgess), Mindarie, Ardrossan, Kangaroo Island (J. G. O. Tepper), Adelaide, Balhannah (E. Guest), Burnside (Prof. Tate); Tasm. (A. Simson).

P. bella var. **rubripes** Roh. S. Aust.

P. rugiceps sp. nov. S. Aust.: Ardrossan and Kangaroo Island.

P. sp. nov. ?. W. Aust.: Badgebup.

Xyloperga halidaii Westw. S. Aust.: Nuriootpa (J. G. O. Tepper).

X. amenaida Kirby. S. Aust.: Kangaroo Island.

X. sp. nov. ?. S. Aust.

DESCRIPTIONS OF AND REMARKS ON NEW OR LITTLE KNOWN SPECIES.

XIPHYDRIA LEAI sp. nov.

♂ Head globose, about as broad as the thorax, not shining; vertex and posterior orbits finely transversely striated and edged behind with a thin carina; face and front reticulate; ocelli in a low triangle well below the supra-orbital line; postocellar line a little longer than the ocellocular line; ocell-occipital line about six times as long as the ocellocular line; middle fovea small and continued downwards as a narrow medial furrow, which disappears just above the antennae; antennal crest inconsiderable; the antennae 21-jointed, distinctly tapering towards the apex; intra-antennal space about four times as long as the antennocular space; scape as long as the third joint, which is as long as 4 + 5; pedicel half as long as the third joint; malar space evidently shorter than the width of the mandibles at the base; clypeus not extending over base of mandibles, broader than long, above not distinctly separated from the face, with fine longitudinal furrows, and with a small median tooth; thorax above finely reticulate, not shining; middle of the pronotum and the frontal part of the middle lobes of mesonotum more sparsely sculptured and somewhat shining; thorax beneath sparsely sculptured, shining; the mesopleurae, however, above more closely sculptured and not shining; abdomen very finely striated across, shining, without bunches of bristles on the sternites; apical sternite posteriorly broadly rounded.

Head fulvous; antennae, tips of mandibles, and a large spot on the vertex and front dark piceous; this spot is laterally deeply incised with a pale stripe, which reaches nearly to the hind margin of the head; a little above the antennae the spot suddenly becomes narrower, and extends forwards as a narrow stripe to base of clypeus; thorax and legs entirely ochraceous; wings hyaline; costa yellow, stigma and other nervures piceous; abdomen ochraceous, genital armature concolorous.

Long. corp., 9·5 mm.; antenna, 4 mm.; exp. alar., 14 mm.

Queensl.: Cairns district. A single specimen collected by Mr. A. M. Lea, after whom the species is named.

This interesting new species seems to me to be nearest to *X. flavopicta* Smith (10, 11) from New Zealand, and to *X. testacea* Mocs. (4) from New Guinea, which I only know from Kirby's figure (1) and from the very brief descriptions. But the new species has entirely piceous antennae and ochraceous thorax and abdomen.

CALIROA LIMACINA Retz.

This species was no doubt imported to Australia from America or Eurasia, and is a serious pest on *Pyrus, Prunus,* and other fruit trees in all parts of the world.

PTERYGOPHORUS CINCTUS Klug.

Morice (5) was of the opinion that *P. distinctus* Roh., *P. insignis* Kirby, and *P. zonalis* Roh. are only aberrative specimens of *P. cinctus* Klug, and I think his opinion is correct.

DIPHAMORPHOS APICALIS sp. nov.

♀ Robust; head as broad as the thorax, behind the eyes a little enlarged, finely and closely punctured, with fine and short hairs, slightly shining, behind not carinated; vertex about four times as broad as long, laterally limited by distinct and deep furrows, and in the middle parted by a fine longitudinal furrow; posterior orbits moderately broad; eyes slightly converging downwards; postocellar furrow superficial; ocelli in a low triangle, the anterior one in the supraorbital line; postocellar line about as long as the ocellocular and ocelloccipital lines; frontal area distinct, but not much elevated, in the middle slightly depressed and laterally limited by not very deep furrows; below the anterior ocellus a fine impression which reaches to the median fovea; the median fovea is small and rounded; frontal crest moderately developed; antennae as long as the abdomen, 14–15-articulated, tapering towards the apex, and inserted close to the clypeus; pedicel as long as the scape; third joint as long as 4 + 5; the intermediate joints thickened apically, about as long as on the apex broad; clypeus apparently short, above and laterally separated from the front by distinct furrows; anterior margin nearly truncate, but, however, apparently rounded; labrum long, semicircular; malar space very narrow; thorax dorsally almost flat, thinly covered with some fine, short, and pale hairs, finely and closely punctured, shining; parapsidal furrows not deep; middle furrow almost wanting, and only in front manifest; scutellum moderately elevated, with some scattered punctures; front wings with the costa a little thickened before the stigma; stigma moderately broad, apically pointed; radial cellule with a very inconsiderable appendice; the first transversocubital nervure obliterated in the middle; legs with the hind tarsi shorter than the tibiae, and hind basitarsus as long as the three following joints together; abdomen very finely sculptured, shining; sheath (from above) short, triangular, apically with long, curved hairs, from the side broadly rounded with nearly straight apex.

Head dark piceous: labrum, base, and middle of the mandibles and palpi whitish yellow; thorax piceous; the angles of the pronotum, tegulae, the hinder sides of the middle lobes of the mesonotum, hind margin of the scutellum, and superior part of the pleurae more or less pale brownish; wings hyaline; base of the costa yellowish, stigma and nervures piceous; tip of coxae, trochanters, and legs pale yellow, femora below (hind femora with the exception of the over-side dark), and tips of hind tibiae and tarsal joints brownish; abdomen dark piceous, with the hinder parts of the segments more or less paler brown.

♂ The antennae are as long as the body, 20-articulated; the hind ocelli in the supraorbital line; hypopygium arcuately emarginated apically.

Thorax dark piceous, nearly black; on thorax only the upper part of the pleurae pale brown; abdomen wholly dark piceous, only the genital armature pale brown; otherwise as in the female.

Long. corp.: ♀ 4·5–5·5 mm., ♂ 4·5 mm. Exp. alar.: ♀ 11–13 mm., ♂ 10 mm.

S. Aust.: Mount Lofty (J. G. O. Tepper), Adelaide, 1.5.13 (H. H. D. Griffith). One female (paratype) from Mount Lofty in my own collection.

N.B.—The specimens from Adelaide are more pallid (the pallid markings being larger) on the infolded margins of the abdominal dorsal plates.

D. tibialis is near allied to *D. nigrescens* Roh., but is hardly identical with this species, judging from the brief description. The clypeus of the new species is not quite truncate, the vertex is parted by a manifest furrow, and the hind tibiae and tarsal joints are dark apically.

POLYCLONUS ATRATUS Kirby.

Rohwer (8) says that the antenna of the female of this species, beyond the second joint, has a ramus like *Pterygophorus*. This remark is not sufficient, because the antennae of *Pterygophorus* are differently constructed. The antenna of the females is 13–15-jointed, and the rami are about as long as the width of the joint (cf. Moriee's fig. 9, pl. xii, *Pterygophorus uniformis*); besides, the colour of this species is otherwise not quite black, but of a visible dark green tinge.

According to Konow (3), *Ancyloneura* Cam. and *Cladomacra* Smith, are congeneric with *Polyclonus* Kirby, but this opinion, as far as concerned to *Ancyloneura*, is certainly wrong (the antennae of the male of *Ancyloneura* are simple, without rami), and the antenna of the figure by Kirby (1) is so differently drawn that, according to my opinion, *Cladomacra* cannot possibly be a *Polyclonus*.

CLARISSA Newman and NEOEURYS Roh.

The differences between the genera *Clarissa* and *Neoeurys* are so insignificant that these, I think, in future ought to be treated as one and the same genus,

but may be divided into some subgenera. Rohwer (7) primarily separates them by the numbers of antennal joints, but Morice (5), having stated the variability of the antennal joint in this group, Rohwer (9) attempts to use the differences in the length of the clypeus to separate *Neoeurys* from *Clarissa*, with little success, however, and the thickness and length of the antennae and legs also vary very much. Most species of *Clarissa* are without metallic colour in contrast with the metallic coloured *Neoeurys*, but *C. anomocera* Roh. and *C. inconspicua* Kirby are, among others, distinctly of metallic colour. In this paper the author separates both these "genera" principally on account of the length and thickness of the antennae and legs. See otherwise remarks on the different new species described by him later on.

CLARISSA CARBONARIA sp. nov.

♀ Head about as wide as the thorax, viewed from the front as long as broad, narrower behind the eyes, finely reticulated, with fine and short hairs, and slightly shining; vertex very short, about four times as broad as long, with distinct lateral furrows, but without postocellar furrow, in the middle parted by a superficial longitudinal impression; posterior orbits narrow; eyes slightly converging downwards; the ocelli in a low triangle, the anterior one just below the supraorbital line; ocelloccipital line about half as long as the ocellocular line; postocellar line about one and a half times as long as the ocellocular line; antennal furrows manifest, but not very deep; frontal area moderately narrow, tapering downwards, the sides slightly elevated from the lateral ocelli to the not very high frontal crest; below the anterior ocellus a broad but shallow impression, which is downwards continued as a shallow furrow to the moderately developed, round median fovea; antennal grooves deep; antennae as long as the thorax, 12-jointed; the third joint is somewhat longer than the fourth, the seventh and the following ones broader than they are long, and on the under-side slightly serrated; supraclypeal area convex; clypeus short, about three times as broad as long, almost flat, in the front slightly depressed, the anterior margin in the middle truncated, but the side-corners slightly rounded; labrum rounded; malar space moderately short; thorax rather convex, finely and closely reticulated, finely and sparsely hairy, slightly shining; parapsidal furrows feeble, being only deeper in front; middle furrow in front deep, posteriorly almost wanting; scutellum slightly convex; the radial cellule in the front wings not appendiculated; stigma narrow and strongly pointed; in the hind wings the radial cellule with a distinct appendix; legs normal; the hind tarsi apparently shorter than the tibiae; hind basitarsus as long as the two following joints together; abdomen with very fine transverse striae, slightly shining; sheath from above short, not very broad, and

backwards tapering, but apically not much pointed, and with some long hairs, viewed from the side longer than the hind tibiae, narrow, and behind rather narrowly rounded.

Wholly black; only the lowest part of the face with a slight green tinge, the palpi brown, and the tips of the femora and bases and spurs of the tibiae dirty whitish-yellow; wings infuscated with a darker shade below the stigma; abdomen wholly black.

Long. corp., 6 mm. Exp. alar., 12 mm. Antenna, 2·5 mm.

N.S. Wales: Forest Reefs (A. M. Lea).

Probably nearest to *C. atrata* Turner (12), but the abdomen is wholly black, and also clypeus and trochanters, without pale markings. *C. anomocera* Roh. is a smaller species, with a manifest metallic green tinge on the body.

CLARISSA VARIABILIS sp. nov.

♀ Head a little narrower than the thorax, narrowed behind the eyes, posteriorly not carinated, very finely and superficially sculptured, very shining, and with fine and short hairs; vertex about three times as broad as long, laterally limited by furrows occurring distinctly only in front, and in the middle divided by a shallow longitudinal furrow; postocellar furrow wanting; posterior orbits rather narrow; eyes converging towards the clypeus; ocelli in a low triangle, the lateral ones in the spuraorbital line; ocelloccipital line about as long as the ocellocular line and the postocellar line; antennal furrows broad and moderately deep; frontal area somewhat elevated, and their edges rounded and tapering downwards: below the anterior ocellus a shallow impression, which is downwards continued as a fine furrow to the oblong and not very great median fovea; between the antennae a very obtuse and low frontal crest; antennal grooves deep; antennae 10–11-jointed, the third joint about as long as the fourth and fifth together, the following shorter, but longer than broad, and on the under-side only very slightly serrated; supraclypeal area long and apparently convex; clypeus nearly as long as broad, flat, above separated from the front by a manifest furrow; tentorial foveae small; anterior margin of the clypeus in the middle truncate, but the side-corners are rounded; labrum apically broadly rounded; malar space not very narrow; thorax moderately convex, very finely reticulated and finely hairy, shining; parapsidal furrows in front deep, but posteriorly very shallow; middle furrow also in front deep, but posteriorly wanting; scutellum slightly convex; radial cellule in the front wings without appendicular cellule; stigma narrow and strongly pointed; the first recurrent nervure interstitial or nearly so; radial cellule in the hind wings truncate and with an appendicular cellule; legs normal; hind tarsi a little shorter than the tibiae, and hind basitarsi about as long as the two following joints together; abdomen with fine

transverse striae, slightly shining; sheath from above very short, broad and backwards broadly rounded, with long curved hairs apically, viewed from the side long and narrow and with narrowly rounded apex.

Head black, sometimes with a slight shifting of metallic green tinge; labrum, palpi, and front part of the clypeus more or less pale brown; thorax black, with slight green shifting on the mesonotum; prothorax reddish; on mesothorax the sides of the lobes of mesonotum and the pleurae reddish; mesosternum black; metathorax black, and only the metapleurae above reddish; tegulae brown; wings hyaline; nervures piceous, the base of the costa and the middle of the stigma a little paler; coxae and trochanters more or less reddish; legs reddish, the fore femora on their base and the tips of the tarsal joints blackish; on the hind legs the femora, the extreme third of the tibiae, and the tarsi almost black; abdomen reddish, without apparent metallic tinge; the propodeum black, the following segments in the middle more or less blackish, the last segment above and the sheath black; the black spots on the dorsum of the abdomen are sometimes very small or wholly wanting.

♂ Head more narrowed behind the eyes, and the vertex also narrower than in the female; antennae somewhat shorter and thicker, and the sutures between the two last joints hardly visible; the apex of the hypopygium broadly rounded.

Head black, with metallic blue or blue-green shiftings; apex of the clypeus and also labrum and palpi pale brownish; thorax black with metallic blue shiftings; coxae, trochanters, and femora for the most part blackish; abdomen black.

Long. corp.: ♀ 5–6 mm., ♂ 4–4·5 mm. Exp. alar.: ♀ 11–14 mm., ♂ 10–12 mm. Antenna, about 2 mm.

S. Aust.: Mount Lofty, taken with sweep net (A. M. Lea and J. G. O. Tepper); Queensl.: Brisbane (A. M. Lea).

This species is probably nearest to *C. atrata* Turner, but is very different in colour. See remarks on the described presumptive varieties of this species.

CLARISSA VARIABILIS var. COLLARIS nov.

♀ Head black with a slight green or aeneous tinge; clypeus, labrum, base, and middle of the mandibles and palpi pale brown; thorax black, more or less shifting in metallic green or aeneous; prothorax reddish; the sides of the lobes of the mesonotum and the upper part of the meso- and metapleurae reddish; abdomen wholly black; antennae 11-jointed; otherwise as in *variabilis* m.

S. Aust.: Melrose, October (A. M. Lea), Kangaroo Island (J. G. O. Tepper).

CLARISSA VARIABILIS var. OBSCURA nov.

♀ Apex of the clypeus, labrum, and palpi pale brown; angles of the pronotum and tegulae reddish; coxae and trochanters for the most part black; front

femora on the basal half black; on the posterior femora only the extreme apex pale; abdomen black; otherwise as in *variabilis* m.

♂ Coloured as in the male of *C. variabilis* m. type.

Long. corp.: ♀ 5 mm., ♂ 4–4·5 mm. Exp. alar.: ♀ 12 mm., ♂ 10–11 mm.

S. Aust.: Melrose, October (A. M. Lea), probably together with var. *collaris* m.

Both these varieties could perhaps be different species, but I cannot find any distinct difference in their structure, and the males collected in company with *variabilis* type and var. *obscura* are similarly coloured. *C. atrata* Turner, which I know only from Turner's description (12), may probably belong to the same species, but is differently coloured. It is still impossible to clear this question without comparison between typical specimens. *C. carbonaria* m. is, among other, less shining, and the praeapical joints of the antennae are broader than long.

NEOEURYS PUSILLUS sp. nov.

♀ Head viewed from above short and broad, posteriorly moderately emarginate, narrowed behind the eyes, finely reticulate, very finely and shortly hairy, moderately shining; vertex short and broad, about four times as broad as long, almost flat, and without median furrow, and laterally not very distinctly limited; postocellar furrow distinct, but not very deep; posterior orbits moderately developed; eyes long oval, a little converging towards the clypeus; ocelli in a very low triangle, the lateral ones in the supraorbital line; postocellar line a little shorter than the ocellocular line, which is about one and a half times as long as the ocelloccipital line; the front apparently broad and convex, and the lateral furrows curved; below the anterior ocellus a shallow but not very narrow furrow which downwards is connected with the moderately deep, elongate median fovea; frontal crest low; interantennal space about twice as long as the antennocular space; antennae 11-jointed, about as long as the thorax, towards the apex a very little thickened; the scape as long and broad as the pedicel; third joint about as long as the two previous joints together and only a little longer than the fourth; the following joints are longer than their breadth, but diminish by degrees in length, and are a little broader on their apical parts, and their lower corner is a little prominent, the antennae not being distinctly serrate, however; the supraclypeal area very convex and moderately long, laterally rather sharply limited by the deep tentorial foveae; clypeus almost flat and in the front depressed, about twice as broad as long, front margin moderately rounded, and the clypeus well defined above by the distinct supraclypeal furrow; labrum moderately short, apically broadly rounded; malar space about as long as the scape; cheeks moderate; thorax not

very convex, very finely reticulated, with fine and short hairs, moderately shining; parapsidial furrows distinct, but only on front deeper; middle lobes of the mesonotum only in front distinctly separated, very little convex; scutellum flat, the praescutellar furrow slightly curved; scutellum behind a little tapering; wings moderately long; stigma strongly tapering to apex; radial cellule without appendice; the first recurrent nervure interstitial with the first transversocubitalis; nervulus very near the middle of the cell; radiellan cellule truncate and followed by a distinct appendicular cellule; legs long and slender; hind tarsi about as long as the tibiae, hind basitarsus a little shorter than the following joints, and the inner spur of the hind tibiae about half as long as the basitarsus; abdomen elongate, posteriorly compressed from the sides and pointed, very finely transversely striated, very finely hairy, rather shining; sheath viewed from above exserted moderately far, very narrow, still narrower towards the base, behind almost truncate, viewed from the side moderately long and narrow, below slightly emarginated, with rather broadly rounded apex, and furnished with some very short hairs.

Head above towards the antennae with a distinct, metallic-cupreous tinge; below the antennae, however, black, but clypeus, labrum, mandibles, and malar space fulvous; palpi greyish, and antennae black with yellow scape; tips of mandibles brownish; prothorax and tegulae fulvous; thorax otherwise cupreous; coxae, trochanters, and legs fulvous; the lower part of hind femora, the posterior part of the hind tibiae, and the tarsi more or less greyish infuscated; wings almost hyaline, nervures pale brown, stigma pale testaceous; abdomen above black, without visible metallic tinge: the two last tergites more or less and the sheath basally fulvous; the infolded margins of the tergites and the venter fulvous.

Long. corp., 3·5–4 mm. Exp. alar., 8 mm.

S. Aust.: Mount Lofty Ranges.

This species is probably nearest to "*Clarissa*" *inconspicua* Kirby, which I know only from Kirby's (2) and Turner's (12) very brief descriptions, but is, among other features, very differently coloured, and is nearly allied to the hitherto known *Neoeurys* species, but has shorter and a little thicker antennae and longer clypeus.

NEOEURYS LEAI sp. nov.

♀ Head a little narrower than the thorax, finely reticulate, finely and shortly hairy, shining, viewed from above short and broad, behind the eyes moderately narrowed and behind slightly arcuately emarginated, viewed from the front a little broader than long; vertex about four times as broad as long, laterally well limited by the distinct and divergent vertical furrows, and in the

middle divided by a very shallow longitudinal furrow; postocellar furrow wanting; ocelli in a low triangle, the lateral ones in the supraorbital line; ocelloccipital line about half as long as the ocellocular line, and postocellar line a very little longer than the ocellocular line; ocellar basin rather distinct; eyes oval, slightly converging towards the clypeus; frontal area broad and moderately convex; middle fovea long, oval, moderately deep, and continued upwards as a shallow furrow to the ocellar basin; lateral furrows distinct; frontal crest not developed; interantennal space about three times as long as the antennocular space; antennae about as long as the thorax, 9-jointed, not distinctly thickened towards the apex, and only slightly serrated below; scape about as long as broad; pedicel a little longer and broader than the scape and a little longer than broad; third joint about one and a half times as long as the fourth; all joints longer than broad; last joint twice as long as its breadth at the base; conic; supraclypeal area moderately long and convex; tentorial foveae small, but deep; clypeus about four times as broad as long, almost flat, its front margin straight; labrum short and broadly rounded; mandibles rather small; malar space about as long as the scape; thorax moderately convex, finely reticulate, finely and sparsely hairy, shining; parapsidal furrows and median furrow only in front distinct; praescutellar furrow slightly curved; scutellum nearly triangular, with a fine longitudinal crest behind; legs moderately long; hind tibiae about as long as the hind tarsi; hind basitarsus about as long as the three following joints together, wings rather long and narrow; stigma long and acuminate; radial cellule without appendicular cellule; first and second cubital cellules equal in length and only a very little shorter than the third; first and second recurrent nervures received in the basal fourth of the second and third cubital cellules; nervulus a little before the middle of the discoidal cellule; radiellan cellule not closed on the outer end; abdomen moderately long, apically compressed from the sides, finely reticulate, very finely and shortly hairy, somewhat shining; sheath viewed from above long, exserted, very narrow, slightly thickened backwards, rounded on the apex, and with some not very long and curved hairs, viewed from the side rather long, not very narrow, on the apex below somewhat roundly excised, and the upper end consequently rather acuminated.

Black with manifest greenish-cupreous shiftings on head and thorax; front part of the clypeus, labrum, base of the mandibles and palpi pale brownish; legs blackish, with knees, tibiae, and tarsi yellowish; the hind femora nearly wholly black, and the tips of the hind tibiae and tarsal joints blackish; wings hyaline; stigma and nervures brown; base of the stigma and costa yellowish; abdomen black, without evident metallic colour.

Long. corp., 3·5 mm. Exp. alar., 8 mm.

S. Aust.: Ooldea (A. M. Lea). Unique.

Apparently nearly allied to *Neoeurys tasmanicus* Roh., but the antennae are 9-jointed, the ocelloccipital line only half as long as the ocellocular line, the basal half of the stigma pale, the sheath not concave above, but viewed from the side slightly excised behind and on the head and thorax more metallic coloured, and besides shorter and more robust.

NEOEURYS AFFINIS sp. nov.

♀ Head viewed from above short and broad, and behind arcuately emarginated, behind the eyes moderately narrowed, viewed from the front about as broad as long, but towards the clypeus very converging, finely reticulate, finely and sparsely hairy and somewhat shining; vertex short, about three times broader than long, slightly convex, in the middle not divided; lateral furrows indistinct and postocellar furrow wanting; posterior orbits rather narrow; ocelli in a low triangle below the supraorbital line; ocellocular line about one-half longer than the ocelloccipital line, and a little shorter than the postocellar line; eyes large, long oval, towards the clypeus somewhat converging; below the anterior ocellus a semicircular impression; frontal area broad, rather convex, with broadly rounded sides; lateral furrows only near the antennae deep; median fovea rather small and longitudinal; frontal crest not developed; interantennal space about twice as long as the antennocular space; antennae 8-jointed, about as long as the thorax, not thickened towards the apex, and not serrate; scape short, nearly as broad as long, a little shorter and smaller than the pedicel, which is a little longer than broad; third joint about one and a half times as long as the fourth; all joints longer than broad; last joint about three times longer than broad; supraclypeal area long and convex; clypeus only about twice as broad as long, basally somewhat convex, but apically depressed, front margin straight, and the side-corners obtuse; supraclypeal furrow indistinct; tentorial foveae rather small; labrum moderately long and apically broadly rounded; mandibles not very robust; malar space a little longer than the scape; thorax moderately convex, very finely striate, finely and sparsely hairy, somewhat shining; parapsidal furrows moderately deep; middle furrow of the mesonotum in front moderately deep; behind wanting; scutellum very slightly convex, shining; praescutellar furrow semicircular; scutellum behind from the sides a little compressed and somewhat angulated; legs moderately long; hind tibiae a little shorter than the hind tarsi, and the hind basitarsi about as long as the three following joints together; the inner spur of the hind tibiae about half as long as the basitarsus; wings rather long and slender; stigma oval, moderately long and acute; radial cellule in the forewings without appendix; the two first cubital cellules equal in length, the third nearly rectangular and a little longer than the second; the first

recurrent nervure nearly interstitial, the second received in the basal fourth of the third cubital cellule; nervulus before the middle of the discoidal cellule: abdomen long oval, on the apex compressed from the sides, finely reticulate, finely and very sparsely hairy, somewhat shining; sheath viewed from above rather long, on the base moderately broad, and narrowed backwards by degrees, and acuminate, and with some not very long and curved hairs on the apex, viewed from the side long, the lower margin nearly straight, and the apex rather narrowly rounded.

Black with a slight blue-green shifting on the upper part of the head and thorax; apex of the clypeus, labrum, base of the mandibles and palpi pale brownish; legs testaceous with coxae, trochanters, the base of the front femora, two-thirds of the hind femora, tips of the hind tibiae, and the tarsal joints more or less blackish; wings hyaline, nervures and stigma brownish, but the base of the stigma and costa pale yellowish.

Long. corp., 3·5–4 mm. Exp. alar., 7–8 mm.

S. Aust.: Port Lincoln (A. M, Lea).

The 8-jointed antennae are, in this genus, uncommon, but I hesitate to create a new genus or subgenus for this species only on account of this, perhaps not constant character. *Clarissa anomocera* Roh., which also has 8-jointed antennae, is perhaps the same species, but is larger, the antennae according to Rohwer (8) thickened apically, the seventh joint with length and width subequal, stigma dark brown without paler base, and hind tibiae without blackish tips.

NEOEURYS SCUTELLATUS sp. nov.

♀ Head a little narrower than the thorax, viewed from above short, behind the eyes apparently narrowed, viewed from the front longer than broad and downwards tapering; head finely reticulate, finely and shortly hairy, shining; vertex about four times as broad as long, laterally limited by distinct furrows, and in the middle divided by a shallow longitudinal furrow; postocellar furrow distinct, in the middle a little curved forwards and on the outsides of the lateral ocelli strongly bent and united with the lateral foveae; posterior orbits narrow; eyes long oval and converging downwards; ocelli in a low triangle, the lateral ones immediately above the supraorbital lines; ocelloccipital line about twice as long as the ocellocular line, which is about as long as the postocellar line; frontal area broad and apparently convex, with broadly rounded sides; below the anterior ocellus a slight longitudinal furrow, which connects downwards with the long and deep wedge-shaped median fovea; lateral furrows very distinct; frontal crest not distinctly developed; interantennal space about three times as long as the antennocular space; antennae moderately long, apically not distinctly

thickened and not distinctly serrated (the left with eight, the right with only two joints, all the rest broken off); scape about as broad as long; pedicel a little longer than the scape; third joint about one and a half times as long as the fourth; all the others distinctly longer than broad; supraclypeal area moderately long, convex; tentorial foveae rather small but deep; clypeus about three times as broad as long, slightly convex, and in the front a little depressed, with straight front margin, and with blunt side-corners; supraclypeal furrow distinct; labrum moderately long, apically broadly rounded; mandibles rather robust; malar space about as long as scape and pedicel together; thorax rather convex, finely striate, finely and shortly hairy, shining; parapsidal furrows distinct, but not very deep; middle furrow only distinct in front, posteriorly wanting; praescutellar furrow easily curved; scutellum posteriorly narrowed, and behind nearly angular, almost flat, very shining, legs long and slender; hind tibiae a little shorter than the hind tarsi; hind basitarsus as long as the three following joints together; front wings with the radial cellule without appendix; stigma rather long and not very much acuminate, broadest on the middle, and with broadly rounded under-margin; second cubital cellule, about as long as the first, and only a little shorter than the third; first recurrent nervure received near the first transversocubital nervure, the second received in the basal fourth of the third cubital cellule; nervulus received in the first third of the discoidal cellule; abdomen rather long, from the sides apically compressed and somewhat acuminated; finely reticulate, shining; sheath viewed from above broad and long, exserted, tapering backwards by degrees, and apically acuminate, and with some not very long, almost straight hairs, viewed from the side long and narrow, with slightly excised under-margin, backwards rather narrowly rounded, but obliquely excised on the apex; saw apparently long and curved, narrow, and acuminate.

Head blackish with slight aeneous shiftings; front part of the clypeus, the two first joints of the antennae, malar space, base of the mandibles, labrum, and palpi fulvous; prothorax and tegulae fulvous; mesonotum blackish with aeneous shiftings, and with a fulvous spot on the sides of the front part of the middle lobes and on the side lobes near the wings; mesopleurae and mesosternum brownish; scutellum on the sides spotted with fulvous; cenchri brownish; metapleurae pale brownish; legs more or less pale brownish, and with yellowish trochanters and knees; wings hyaline; stigma and nervures brownish; base of the stigma and nervures basally pale yellowish; abdomen fulvous; the dorsum, except the last segment, blackish; the extreme point of the sheath black.

Long. corp., 5 mm. Exp. alar., 11 mm.

Tasm.: Hobart (A. M. Lea). The type is not in good condition, but is no doubt a distinct species.

NEOEURYS VENTRALIS sp. nov.

♀ Head about as wide as the thorax, viewed from above short and broad, seen from the front a little broader than long, behind the eyes a little narrowed, finely reticulate, and besides with some very fine and sparse punctures, finely and sparsely hairy, very slightly shining; vertex very short, about four times as broad as long, laterally distinctly limited by not very deep lateral furrows, in the middle with a very slight longitudinal impression; postocellar furrow wanting; posterior orbits moderately developed; ocelli in a low triangle; the lateral ocelli just below the supraorbital line; ocellocular line about as long as the postocellar line and about twice as long as the ocelloccipital line; eyes moderately large, oval, converging towards the clypeus; frontal area above the median fovea elevated, and with rounded, broadly declivous sides; lateral furrows distinct; below the anterior ocellus a narrow and moderately deep, longitudinal, and shining furrow which downwards is connected with the small and not very deeply impressed median fovea; front below the median fovea almost flat; frontal crest not developed; antennae 14-jointed, slender, about as long as head and thorax together, not conspicuously thickened towards the apex, and not serrated; scape somewhat longer than the pedicel and a little longer than broad; pedicel about as long as broad; third joint longer than the fourth; the following joints diminishing by degrees; last joint obtuse and only very little longer than broad; supraclypeal area convex and rather long; tentorial fovea deep, but not very large; clypeus about three times as broad as long, almost flat, with rounded side-corners, and with a very small rounded incision in the middle of the front margin; supraclypeal furrow indistinct; labrum moderately long, and with broadly rounded apex; malar space about as long as the scape; cheeks not very robust; thorax moderately convex, finely reticulate, and with some hardly noticeable punctures, finely and sparsely hairy, somewhat shining; parapsidal furrows moderately deep; middle lobe of the mesonotum in front with a deep middle furrow, missing behind; scutellum behind a little compressed from the sides, slightly convex, shining; mesosternum impunctate, very shining; legs long and slender; hind tarsi a little longer than the hind tibiae, hind basitarsus a little shorter than the following joints together; wings long and proportionally slender; stigma long and acuminate; radial cellule in the forewings without appendix; the two first cubital cellules about equal in length; the third rectangular and a little longer than the second; first recurrent nervure received in the basal fifth and the second in the basal fourth of the cubital cellules; nervulus before the middle of the discoidal cellule; abdomen finely tranverse-reticulated, and with some moderately small remote punctures, somewhat shining; sheath viewed from above short, moderately broad, tapering backwards, and with obtusely pointed

apex, and with some long and curved hairs, viewed from the side moderately long, slightly emarginated below and rounded behind.

Head metallic, with more or less intense cupreous or golden gleams; antennae black; scape, labrum, and palpi fulvous; thorax metallic-green, with cupreous gleams on the mesonotum; legs fulvous, their hind femora more or less black with a slight metallic gleam; the tips of the hind tibiae and the tarsal joints slightly infuscated; wings almost hyaline; nervures and stigma pale brownish, with the base of the stigma and costa pale yellowish; abdomen on the base of the dorsum black, with a slight greenish tinge, apically and underneath with the sheath fulvous.

Long. corp., 5 mm. Exp. alar., 10–11 mm.

Tasm.: Cradle Mountain (H. J. Carter and A. M. Lea).

The scape in one specimen is black and the femora more fulvous.

Nearly allied to *N. tasmanicus* Roh. and *N. caudatus* Morice, but differently coloured. This species cannot be only a colour variety of those, because the sheath and the saw are differently shaped. Hitherto the males of these species could not be distinguished one from the other with certainty. See Morice's (5) remarks on the males.

CEREALCES SCUTELLATA Kirby.

The female of this species and genus was hitherto unknown, and may be described as follows:

Robust; head a little narrower than the thorax, behind the eyes apparently dilated, coarsely and very densely punctured, with very short and feeble hairs, slightly shining, only on the posterior orbits more sparsely punctured; vertex a little broader than long, laterally defined by manifest furrows, but postocellar furrow almost wanting; eyes small, oval, parallel; posterior orbits moderately broad; ocelli in a low triangle, the lateral ones just below the supraorbital line and a little elevated, but the anterior ocellus a little impressed in the front; postocellar line about as long as the ocellocular line and somewhat longer than the ocelloccipital line; frontal area not very apparent, in the middle a little depressed; median fovea rounded and moderately deep; frontal crest very high; antennal furrows manifest; antennae low, inserted near the clypeus; antennocular space about a third of the interantennal space; antennae shorter than the thorax, dilated apically and somewhat club-like, 10-jointed, but the three last joints not very distinctly separated; the third joint a little shorter than the fourth and fifth together; the third to seventh dilated on their ends; the three last joints as broad as long; face below the antennae short, in the middle depressed, laterally elevated and limited by the deep tentorial foveae; clypeus about three times as

broad as long, above limited by a distinct supraclypeal furrow, almost flat, in front moderately excised; labrum small, apically rounded; mandibles robust; malar space linear; thorax coarsely and densely punctured, very finely and sparsely hairy, slightly shining, moderately convex; pronotum in front depressed, in the middle transverse striate, behind elevated and posteriorly deeply emarginated; parapsidal furrows moderately deep, the middle furrow deep and only wanting behind; mesonotum marginated behind; scutellum almost plain, in the middle divided by a deep longitudinal furrow, the anterior furrow deep and a very little curved; the scutellum is behind sharply margined, and on the sides produced into sharply-pointed lobes; hind tibiae apparently long, slightly S-curved, at the base and apex thickened, with a small knot behind between the first and middle third, and with a middle spur in front between the middle and last third; the apical spurs only a little shorter than the basitarsus; hind tarsi half as long as the tibiae; basitarsus shorter than the two following joints together; claws simple; front wings with a small appendicular radial cellule; the second recurrent nervure nearly interstitial; propodeum sharply transversely striated, dull; abdomen nearly cylindric and finely transversely reticulated, slightly shining; sheath from above apparently short and hardly visible, broad, posteriorly rounded, and with some long hairs, viewed from the side moderately long and apically strongly rounded.

Head black; a small spot on the hind angles of the vertex, a long stripe on the posterior orbits, a small spot above and below the antennae, a little larger spot between the antennae and the eyes and the hind part of the clypeus yellow; the base of the mandibles and palpi brown; thorax black; the lateral and hind margins and the angles of the pronotum, the lateral margins of the side-lobes of the mesonotum, as well as a small spot on the middle of the mesopleurae, and the parapterum, the epimera of the mesopleurae all yellow; tegulae pale brown; scutellum brown with paler margins; coxae on their tips and the trochanters more or less pale yellow; femora black; the intermediate femora above with a pale stripe and the hind femora broadly striped with yellow above, but the knees black; tibiae and tarsal joints yellowish, with brownish tips on the hind legs; wings slightly yellowish; nervures and stigma dark piceous; the basal half of the costa and base of some other nervures yellowish; abdomen piceous; the second and sixth tergites behind broadly margined with yellow, and the other tergites in front and behind a little paler brownish; venter more or less pale brown; sheath posteriorly brown.

Long. corp., 14 mm. Exp. alar., 25 mm.

The single female was collected at Sydney, is much more robust than the male, and reminds one of some species of *Perga*.

PERGA DORSALIS Leach.

Perga affinis Kirby is certainly not a distinct species, rather only a variety of *P. dorsalis* Leach.

PERGA SCHIODTEI Westw.

The female described by Westwood (13) in his monograph is apparently not the true female of this species, as Morice (5) has already stated. He describes the true female briefly, giving information only concerning its colour.

Head a little narrower than the thorax, from above short, and behind the eyes not dilated, above coarsely and densely punctured, dull, below more sparsely punctured and shining, sparsely and very finely hairy; vertex nearly as wide as long, slightly convex, on the sides sharply limited, in front defined by a slight postocellar furrow, and in the middle divided by a slight longitudinal furrow; posterior orbits moderately developed; eyes rather large, slightly oval, parallel; ocelli in a moderate low triangle, the lateral ones just below the supraorbital line; postocellar line about as long as the ocellocular line, and somewhat shorter than the ocelloccipital line; the anterior ocellus impressed in the front, and the lateral ocelli pressed outwards by a sharply-edged crest, which begins in the middle of the front margin of the vertex, these being downwards broader, higher, and obtuse, and passing to the antennae; below the anterior ocellus is a not very deep groove, downwards continued as a narrow furrow, which traverses the moderately convex face to the clypeus; antennal furrows manifest; antennae about as long as the interocular space, 6-jointed; the intermediate joints longer than broad; clypeus about four times as broad as long, in front truncate, with some moderately great but remote punctures, very shining; labrum about semicircular; malar space very short; thorax coarsely and densely punctured, almost dull; scutellum with some large but remote punctures, shining, and without middle furrow; forewings with the third cubital nervure strongly curved and the first not obliterated; the hind tarsi of the male about as long as the tibiae, of the female apparently shorter (5 : 6·5); abdomen with some fine punctures, on the propodeum very finely reticulate, shining, sheath from above short and not very broad, behind nearly truncated, with dense, but moderately long hairs, viewed from the side strongly curved, but apically truncated; hypopygium of the male truncated behind.

The metallic gleams on the side lobes of the mesonotum and the dorsum of the abdomen are only evident in some aspects. The figure in Westwood's paper is very good. In the female the hind tibiae on their last third are blackened.

Does this species in fact occur at Adelaide, in South Australia, as Westwood writes? The South Australian Museum possesses no specimens from

South Australia. The above described specimens were collected in Western Australia (Warren River), and all the specimens described by Morice were from Western Australia (Swan River).

PERGA BREVIPES sp. nov.

♀ Head from above short, from the front depressed and about as long as wide, behind the eyes a little dilated, with remote but large punctures, very shining, moderately hairy; vertex large, a little broader than long; lateral furrows distinct, postocellar furrow slightly impressed, median furrow not developed; posterior orbits moderate; eyes not very large, oval, not converging downwards; ocelli in an apparently low triangle, well below the supraorbital line; postocellar line a little longer than the ocellocular line, but ocelloccipital line about one and a half times as long as the postocellar line; below the anterior ocellus a distinct furrow, which below the interantennal space is enlarged to an almost plain triangular area; antennal crest wanting, but above the antennae a moderately broad and high crest upwards, being enlarged, and by degrees disappearing below the lateral ocellus; antennal furrows moderately deep; antennae a very little longer than the distance between them, 6-jointed, inserted near the clypeus; scape broad, and about twice longer and distinctly broader than the pedicel, which is much broader than long; the following joints are short, but the third and fourth distinctly longer than their width; the fifth about as long as the width of the apex; the sixth club-like and as long as the three previous joints together; tentorial foveae not very deep; clypeus about four times as broad as long, almost plain, in front not very deeply emarginated; labrum moderately long, apically broadly rounded; cheeks robust; malar space linear; thorax broad and apparently convex, largely and densely punctured, very slightly shining, sparsely hairy; parapsidal furrows moderately deep, median furrow in front deep, but wanting behind; side lobes of the mesonotum with two longitudinal furrows, and on the sides somewhat carinated; scutellum large, almost flat, largely but not very closely punctured, and more shining than the rest of the notum, without middle furrow; forewings with the third cubital nervure strongly curved; hind tarsi short, shorter than the half of the hind tibiae; hind basitarsus a little longer than the three following joints together; abdomen almost broad, a little depressed, and behind a little compressed from the sides; propodeum coarsely and densely punctured, and with apparently dense hairs; abdomen otherwise with very fine reticulae and shining; sheath viewed from above moderately narrow, short, with nearly parallel sides, posteriorly truncate, and with long and curved hairs, from the sides not very long, strongly curved, but on the apex straightly excised.

Head pale brownish-yellow; mandibles on the apex piceous; front with a blackish spot round the ocelli; the prothorax, the posterior corner of the middle lobe of the mesonotum, the margins of the lateral lobes, the scutellum, and the upper parts of the pleurae all yellowish; meso- and metasternum blackish, and the hind coxae more or less piceous; wings yellowish, nervures yellowish-brown, the stigma in the middle darker brown; abdomen pale yellowish brown; in some specimens the dorsum of the abdomen almost entirely blackish, with violaceous gleams in certain lights; in other specimens this spot is more or less reduced, sometimes to a narrow dark line in the middle of the abdomen; the middle of the venter more or less infuscated; the base of the sheath piceous.

Long. corp., 17–21 mm. Exp. alar., 36–40 mm.

S. Aust.: Yeelanna (W. J. Spafford), Kangaroo Island (J. G. O. Tepper).

In Morice's table of the genus *Perga* this new species runs to *belinda* Kirby or to the *klugii* group. *P. belinda* Kirby is very differently coloured, the hind tarsi are long, and the first cubital nervure is nearly obsolete. In the *klugii* group the antennae are longer in all species. *P. klugii* besides has the scutellum impunctate, *P. kirbii* Leach has a dense and rugose punctured scutellum, which also is bisected by a distinct longitudinal impression, *P. brevitarsis* Morice likewise has the scutellum in the middle bisected and with only very few and hardly noticeable punctures, and *P. agnata* Morice, as the last, has the hind tarsi of normal length.

PERGA MAYRII Westw.

In some specimens of this species the scutellum is wholly black.

PERGA CRESSONI Westw.

The abdomen of this species is sometimes more or less blackish.

PERGA CHRISTII Westw.

The antennae of this species, which, according to Morice hitherto not described, are very short and pale yellow, with infuscated scape and pedicellum.

PERGA WAITEI sp. nov.

♀ Head from above short, considerably more slender than the thorax, and behind the eyes a little narrowed, viewed from the front about as broad as long, sparsely and shortly hairy, coarsely, but more or less remotely punctured, shining; vertex large, a little broader than long, moderately convex, in the middle divided by a distinct longitudinal furrow, and with some coarse punctures; vertical furrows deep; postocellar furrow laterally distinct, but in the middle

wanting; posterior orbits narrow; eyes large and parallel; front more densely punctured; ocelli in a low triangle well below the supraorbital line; the anterior ocellus impressed in the front and surrounded by a distinct furrow, which is forwards continued as an inconsiderable, elongate median fovea; the frontal area is in the middle impressed and laterally edged with not very high but forwards dilated crests; ocelloccipital line about twice as long as the ocellocular line, and about equal in length with the postocellar line; frontal crest not very distinctly developed, and in the middle broadly interrupted; antennal foveae not very apparent; the antennae are 6-jointed, very short, and only about as long as the interantennal space; scape evidently longer and broader than the short pedicel; the third joint twice as long as its width, the two following joints broader than long, and the sixth joint as long as the three previous joints together; supraclypeal area short, in the middle concave, and laterally limited by moderately high crests; tentorial foveae deep; clypeus short, flat, about four times broader than long, in the front nearly truncate, but in the middle with a short incision, and with obliquely truncated side-corners, and basally limited by a manifest supraclypeal furrow; labrum moderately long, apically rounded; mandibles robust; malar space very short; thorax broad and high, coarsely and closely punctured, almost dull, sparsely hairy; pronotum short, vertical, behind deeply excised, with an apparent obtuse side-bump, and on the side-angles more remotely punctured and shining; parapsidal furrows deep; middle furrow deep, but posteriorly wanting; side lobes of the mesonotum on the sides with a distinct longitudinal furrow and laterally sharply edged; scutellum almost flat, in the middle with a very short longitudinal impression, and with some coarse and remote punctures, besides some fine and hardly visible ones, it is very shining, and has small hind lobes; mesopleurae with coarse and remote punctures, shining; forewings with the stigma long and acuminate, and with the anterior margin apparently curved; the first transversocubitalis only in the middle a little paler, and the third nervure strongly curved; hind tarsus distinctly shorter than half of the hind tibia, and the hind basitarsus longer than the three following joints together; abdomen sparsely hairy and finely transversely striate, with some remote and coarse, but not very deep, punctures, very shining; sheath viewed from above short, broad, narrowed backwards, but on the apex truncated, with close but moderately long hairs, viewed from the sides moderately long, strongly curved, but on the apex obliquely truncated.

Head, antennae, and palpi sulphureous; occiput partly, a large spot which covers the vertex, a part of the posterior orbits, the front, the face to somewhat below the anterior ocellus, a stripe to the clypeus and the supraclypeal furrow, blackish with a faint blue tinge; tips of the mandibles piceous; thorax black with yellow markings; prothorax in the middle black, the margins yellow; tegulae yellow; mesonotum black, the hind corner of the middle lobe yellow, and the sides

of the lateral lobes marked with yellow; scutellum and hind-corners yellow; mesopleurae yellow, but meso- and metasterna black; metapleurae marked with yellow; wings hyaline, with a slight yellowish tinge; costa and bases of the other nervures yellow, but stigma and the rest of the nervures brownish; legs yellow; bases of the middle and hind coxae blackish; coxae and trochanters otherwise yellow; abdomen dorsally and ventrally broadly black, with bluish gleams; base of the sheath blackish.

Long. corp., 19 mm. Exp. alar., 36 mm.

S. Aust.: Murray River (H. S. Cope). Unique.

In Morice's key this species runs to *P. christii* Westw., but is very differently coloured and punctured, and besides is larger and more robust.

Named in honour of Mr. Edgar R. Waite, Director of the South Australian Museum.

PERGA MORICEI sp. nov.

♀ Head a little narrower than the thorax, behind the eyes not narrowed, densely and coarsely punctured, with moderately dense and short hairs, almost dull; vertex large, slightly convex, about as broad as long, in front a little broader than behind, in the middle with a moderately deep longitudinal furrow; lateral furrows and postocellar furrow deep; hind orbits moderately developed; lateral ocelli just below the supraorbital line; occiloccipital line about one and a half times as long as the ocellocular and the postocellar lines; the anterior ocellus a little impressed in the front, and surrounded by a distinct but not very deep furrow, which is continued forwards as a broad but moderately deep furrow, and reaches the clypeus; frontal crest high, but not very sharp; in the middle broadly and deeply interrupted; lateral foveae distinct; eyes oval, moderately large; antennae 6-jointed, very little longer than the interantennal space; the scape is longer but not much broader than the pedicel, which is broader than long, the last joint a little longer than the three previous joints together; supraclypeal area moderately short and laterally limited by longitudinal crests; clypeus almost flat, about three times as broad as long, with some remote punctures, in front broadly, but shallowly emarginated, and with a shallow, little curved transverse impression, and with rounded side-corners; basally limited by a distinct furrow; labrum moderately long, apically broadly rounded; malar space short; mandibles robust; thorax moderately convex, densely and rugosely punctured, sparsely and shortly hairy, almost dull; pronotum short, behind deeply emarginated, on the side lobes in the middle impressed; parapsidal furrows distinct, but not deep; median furrow distinct, but behind wanting, and the hind corner of the middle lobe without punctures, and shining; lateral lobes laterally sharply margined; scutellum almost flat, with some remote but coarse

punctures, and in the middle with a shallow longitudinal furrow, shining; mesopleurae and mesosternum with coarse but not very dense punctures, shining; forewings with a moderately large radial appendicular cell, long and acuminate stigma, the first transversocubital nervure not really absent, but pale; the third nervure not very strongly curved; hind tarsi somewhat shorter than the hind tibiae, and the hind metatarsus as long as the two following joints together; abdomen very finely reticulate, and the tergites besides with remote punctures on the hind margins, sparsely and finely hairy, and very shining; the abdomen on the apex a little compressed from the sides; sheath viewed from above small, but dilated backwards, and behind slightly truncated, and furnished with some moderately long and curved hairs, viewed from the side long, and strongly curved apically.

Head pale chestnut-brown; the antennae dark brown, and the tips of the mandibles piceous; the middle of the vertex, lateral parts of the lateral orbits, supraclypeal area, clypeus, and labrum yellowish; thorax pale chestnut-brown; the pronotum and tegulae, the hind corner of the middle lobe of mesonotum, scutellum, postscutellum, and pleurae yellowish; forelegs, trochanters, and coxae yellowish; the hind legs dark chestnut-brown; wings slightly yellowish, stigma and nervures more or less brownish; abdomen dorsally pale brownish, ventrally yellowish.

Long. corp., 17–18 mm. Exp. alar., 24–26 mm.

W. Aust.: Boulder, Jan. 24, 1899 (A. Bethune).

This new species is probably nearest to *P. belinda* Kirby, but is larger, the thorax paler yellowish, and the head behind the eyes with blackish spots. Morice (5) states that the hind tarsi are pale, but Kirby (1) describes them as reddish-chestnut. The saw of the new species differs very much from the saw of *P. belinda* (according to Morice's photograph), and is more like the saw of *P. esenbecki* Westw.

Named in honour of the Rev. F. D. Morice, who by his type-studies of the Australian sawflies has very much contributed to the knowledge of these interesting insects.

PERGA RUBRIPES Roh.

I think *Perga rubripes* Roh. is only a colour variety of the common species *P. bella* Newm.

PERGA RUGICEPS sp. nov.

♀ Head broad, nearly as broad as the thorax, behind the eyes somewhat dilated, above wholly coarsely rugose, dull, on the lateral orbits and below the antennae more remotely punctured and shining, with short remote hairs; vertex large, somewhat convex, about as broad as long, in the middle without manifest furrow; vertical furrows distinct, but not very deep; postocellar furrow shallow;

posterior orbits large; lateral ocelli a little elevated in the supraorbital line; the anterior ocellus impressed in the front, and surrounded by a distinct furrow, which is continued forwards as a moderately broad furrow; ocelloccipital line considerably longer than the ocellocular line, which is about equal in length with the postocellar line; frontal area narrow, moderately depressed, and laterally limited by not very high crests; lateral foveae distinct; eyes oval, moderately large, parallel; antennae 6-jointed, low inserted, a little longer than the interantennal space; scape evidently longer, but not much broader than the short pedicel; the three following joints very little longer than broad, and the sixth about as long as the three previous joints together; frontal crest not very distinct, and incised by a moderately broad furrow; supraclypeal area short; tentorial foveae moderately deep; clypeus short, about three times broader than long, in the middle of the anterior margin slightly incised, almost flat, and with rounded side-corners, basally limited by a deep furrow; labrum short, apically broadly rounded; mandibles robust; malar space rather short; thorax moderately convex, coarsely rugose, dull; pronotum short, and behind deeply emarginated; parapsidal furrows distinct, moderately deep; middle furrow deep, but posteriorly wanting; posterior corner of the middle lobe shining; lateral lobes shallowly furrowed and laterally sharply margined; scutellum almost flat, with some coarse, remote punctures, and in the middle with a shallow longitudinal impression; hind-corners moderately small; mesopleurae rugose; mesosternum remotely punctured and shining; forewings with an apparently large appendicular cell; the first transversocubital nervure distinct, the third strongly curved; stigma moderately long and acuminate; hind tarsi longer than the half hind tibia; hind basitarsus as long as the three following joints together; abdomen a little depressed from above, backwards acuminate and compressed from the sides, very finely transversely reticulate, and with some shallow and remote punctures on the hind margins of the tergites; sheath from above apparently short, narrow, rather acuminated backwards, moderately hairy, viewed from the sides long and rather strongly curved.

Head dark chestnut-brown, the middle of the vertex, lateral orbits, antennal crests, antennae, and the face below the antennae paler yellowish; thorax chestnut-brown, the tegulae, hind corner of the middle lobe of the mesonotum, scutellum, and mesopleurae paler yellowish; legs yellowish; the apices of the hind femora, tibiae, and tarsal joints infuscated; forewings somewhat yellowish, with pale brown stigma and nervures; hindwings almost hyaline; abdomen above pale brownish, below paler yellowish.

♂ The forewings are more curved near the stigma, the stigma is a little less acuminate, the abdomen is more depressed, and the last ventral-segment is moderately long, behind broadly rounded, but in the middle slightly sinuated. The dark spot on the head is more blackish, but the vertex wholly pale, the middle

and side lobes of the mesonotum in the middle blackish; otherwise as in the female.

Long. corp., 15–18 mm. Exp. alar., 30–31 mm.

S. Aust.: Ardrossan and Kangaroo Island (J. G. O. Tepper).

This species seems to be nearest to *P. belinda* Kirby, but the antennae are not black, the tips of the posterior femora, tibiae, and tarsal joints are distinctly blackened; the third to fifth joints of the antennae are as long as broad.

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NOTES ON AND DESCRIPTIONS OF CHALCID WASPS (CHALCIDIDAE) IN THE SOUTH AUSTRALIAN MUSEUM

BY A. A. GIRAULT, ASSISTANT GOVERNMENT ENTOMOLOGIST, QUEENSLAND

Summary

The following is based upon material kindly loaned to me for study by the Director of the South Australian Museum at Adelaide. Descriptions of a few new forms collected by other than members of this Museum are included. All of the types are deposited at Adelaide, cotypes in the Queensland Museum, Brisbane.

NOTES ON AND DESCRIPTIONS OF CHALCID WASPS (CHALCIDIDAE) IN THE SOUTH AUSTRALIAN MUSEUM

By A. A. GIRAULT, Assistant Government Entomologist, Queensland.

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Sub-Family MYMARINAE.

STETHYNIUM Enock.

STETHYNIUM POEMA sp. nov.

Runs to *S. cinctiventris*, but golden, abdomen except more or less of margins, phragma, axillae except hind margins, cephalic half parapsides, sclerites between axillae, scutum except distal ¼ and lateral margins narrowly, black. Tibiae 2–3 dusky, so flagellum. Fringes half wing width; hind wings 5 lines discal cilia, 3 cephalic; 24 lines fine discal cilia on fore wing, the ciliation extending to opposite base of marginal. Funicles, except last two, cylindrical, 1 twice longer than wide, equal pedicel, 2–3 longest, not thrice longer than wide, distal two oval, equal, shortest.

Male black, centre of vertex and face, lateral pronotum widely and scutellum laterad of lateral sulcus, silvery-golden, legs as in female, but femur 3 also dusky; joints flagellum (excluding pedicel) twice longer than wide.

S. Aust.: Melrose (A. M. Lea). Two males and one female, October.

Sub-Family TRICHOGRAMMATINAE.

JAPANIA Girault.

JAPANIA TRISTIS Girault.

One female with the above *Stethynium*. The antennae were missing. The first pair of tibiae above bear weak teeth.

Sub-Family ENCYRTINAE.

TACHINAEPHAGUS Girault.

TACHINAEPHAGUS AUSTRALIENSIS Girault.

Many specimens of both sexes from Dipterous puparia, Adelaide. Also

from a puparium taken from an opossum's nest, Adelaide. Evidently widely distributed.

PARANUSIA Girault.

PARANUSIA LONGISCAPUS Girault.

One female reared from ants, Liverpool, N.S. Wales (A. M. Lea). This specimen was entirely black.

EPANUSIA Girault.

EPANUSIA BEENLEIGHI Girault.

A female, Sydney, N.S. Wales (A. M. Lea).

HEXANUSIA Girault.

HEXANUSIA SANGUINITHORAX sp. nov.

Differs from the genotype: Stigmal, postmarginal equal, distinctly shorter than marginal, latter two and a half times longer than wide and nearly twice the stigmal. Frons a bit narrower. Abdomen short, depressed, triangular, smaller than thorax. In male stigmal a bit shorter than postmarginal.

Red, wings clear, head, abdomen purple, also face of prothorax and apical scutellum; pedicel above, club aeneus, funicle more or less dusky. Funicle 1 a bit longer than wide, a bit shorter than pedicel, 6 somewhat wider than long.

Vertex punctate, two rows punctures along frons on each side; lateral ocellus barely separated from eye, equidistant. Upper thorax densely setose, scape long.

Male with prothorax, scutellum, cephalic margin scutum across meson widely, scutum at meson caudal margin, lateral propodeum, flagellum except apex pedicel, basal half scape, purple, also coxae 1–2 in front, much of femora 1 and 3 on dorsal edge. Club solid, funicles a bit longer than wide, 1 a half longer than wide, shorter than club, pedicel shorter than funicle 2, hairs dense and longer than in female, but not long.

Has general appearance of *Tachinaephagus australiensis* Girault. The hairless line has four lines of cilia on the basal side of it in pairs, separated except caudad, where joining, the whole curves toward base.

Queensl.: Innisfail, from syrphid puparia (J. L. Froggatt), July, 1926. Host: *Syrphus balteatus*.

ANUSOIDEA Girault.

ANUSOIDEA VARIA sp. nov.

Differs from *A. aureiscutellum* in that mesopleurum, prepectus, coxa 3, femur 1 except silvery base, tibia 1 at base (rest yellow), rest of legs, purple;

apex tibia 2, tarsi, yellow. The postmarginal vein is pale and not half as long as the marginal; the straight elongate stigmal somewhat exceeds the marginal.

N.S. Wales: Stanwell Park (A. M. Lea). One female.

TANEOSTIGMODES Ashmead.

TANEOSTIGMODES UNIFASCIA sp. nov.

In the table of species as follows: Ia. Scape the same; pedicel and ring-joints black. (Apex scape's dilation truncate and with a scooped-out margin, this emargination not great.) Funicle 1 slightly longer than wide, larger but not longer than the pedicel. Hairs of club not longer than those of funicle. Three loose lines discal cilia between marginal vein and the rather obscure hairless line. Wings lightly embrowned between bend of submarginal and apex of stigmal.

Dull black; dilation of scape, venation, head except vertex, upper side occiput, lower genae and a narrow line (and ridge) across joining the lower end of the eyes and passing just under antennae; propleurum, tarsi, knees, tibia 1 more or less, tibial tips, tegulae, cephalic ¼ mesopleurum, golden. Abdomen scaly, thorax finely reticulated. Distal funicle much wider than long.

S. Aust.: Mount Lofty (A. M. Lea). One female.

SUB-FAMILY EUPELMINAE.

EUPELMUS Dalman.

EUPELMUS UNIPUNCTIPENNIS sp. nov.

In my revised table of this large Australian genus, runs to *E. lutheri*, and is a typical member of the genus with approaching axillae.

Entirely blue except knees 1–2, tibial tips, and tarsi. Ovipositor half length of abdomen. Wings clear, but with a distinct, large, rounded, brown spot appended from costa near apex postmarginal vein, latter nearly twice the long, curved stigmal. Lateral ocellus a bit closer to eye than to median. Cheeks with longish hairs. Mesopleurum with only sparse hairs cephalo-ventrad. Hairs from proventer not long.

Funicles 2–4 twice longer than wide or nearly, longest, longer than pedicel, others shortening (last 5 antennals missing). Scape with a distinct, rectangular foliaceous expansion.

Tasm.: Mount Arthur, Dec., 1915 (F. M. Littler). One example.

SUB-FAMILY CLEONYMINAE.

MESAMOTURA Girault.

MESAMOTURA KEATSI sp. nov.

Like *M. corticis*, but femur 3 aeneus except basal $\frac{1}{3}$, base tibia 3 shortly black; basal thick part of ovipositor not $\frac{1}{3}$ ovipositor, which exceeds length of body; leg 2 more or less purple; base of dilation of tibia 3 proximad of middle.

Queensl.: Kuranda, Nov., 1919 (A. P. Dodd). One female.

MESAMOTURA AESCHYLI sp. nov.

As *M. keatsi*, but in femur 3 only distal $\frac{1}{6}$ red, tibia 3 with no black at base, ovipositor shorter than body, basal thick part not a half; base of the dilation of tibia 3 slightly proximad of middle; leg 2 except coxae and the paler tarsi, red; tarsus 3 not white, black after joint 1.

Queensl.: Nelson, July, 1920 (A. P. Dodd). One female.

The species are to be collected from the trunks of dying trees, and are doubtless associated with wood-inhabiting Coleoptera.

SCHIZONOTELLA gen. nov.

Legs simple, third femur a bit thickened. Habitus of *Eupelmus*. Middle of propodeum with an erect column, two black hair tufts on forewing, one off base of bend of submarginal vein, the other on base of marginal. Prothorax long, obconical, a bit exceeding length of scutum; furrows complete, widely separated. Propodeum with distinct lateral carinae and a carina laterad of the subcentral, small, round spiracle. Petiole quadrate, rest of segments (2, 4–7) large, 3 very short, ovipositor $\frac{3}{4}$ abdomen. Lateral ocellus twice closer to median than to eye, near median. Hind tibial spurs small, the smaller minute. Postmarginal elongate, twice the stigmal. Antennae 11 jointed, club solid, below eyes.

SCHIZONOTELLA EUPELMOIDEA sp. nov.

Orange; apex coxa 3, base femur 2 and of tibia 3, ovipositor except distal $\frac{1}{4}$ plus, tarsi, white; scutellum between its 4 bristles, base to apex, abdomen, pronotum candad more or less, leg 3, axillae, coxa 2, trochanter 2, tibia 2 at base, purple; apex ovipositor black, also club and distal two funicles; funicle 1 a ring-joint, stout, 2 four times longer than wide, 8 twice longer than wide, 2 equal the elongate pedicel. Scaly, frons cephalad of ocelli, glabrous; sculpture coarser on scutum.

Forewing infuscated from first hair tuft nearly to apex and with four hyaline spots in pairs at opposite margins, second pair apex stigmal vein.

Queensl.: Kuranda, Oct., 1919 (A. P. Dodd). One female.

ALIGHERINIA Girault.

ALIGHERINIA ANGUSTIFRONS sp. nov.

As genotype, but scutellum but slightly convex, not mound-shaped, ovipositor extruded for length equal that of abdomen, or nearly, the frons back of ocelli narrow, lateral ocelli barely separated from eye and closer together than either is distant from median. Frons where narrowest more than diameter of an ocellus. Eyes closely pilose. Spiracle round, the propodeum with a median carina, fuzzy laterad and behind. Segment 2 subequal 5, largest, 3 and 4 each shorter by a bit. Femur 1 somewhat swollen and slightly excised beneath at apex. Frons-vertex long, wedge-shaped, cephalic margin carinate. Scrobes short. Pedicel elongate, equal funicle 2, which is four times the quadrate 1 and also equal to the solid club; funicle 3 twice longer than wide, rest shorter. Femur 3 beneath with edges carinate but quite straight.

Entirely aeneus; tarsi except joint 5 and tarsus 3, joints 2–5, white; dorsal aspect tibia 3 ivory white. Forewing brown across from all of marginal and stigmal veins. Dorsal thorax densely shagreened (except propodeum only), scutellum without median carina.

Queensl.: Kuranda, Dec., 1919 (F. P. Dodd). One female.

The narrow ivory on dorsal tibia 3 is not always present. Sometimes femur 2 bears a yellow-white spot at apex on one side.

EPISTENIA Westwood.

Differs from *Thaumasura* in that the antennae are inserted on a level with the ventral ends of the eyes, or a bit lower. The two hind tibial spurs, though unequal, are not elongate, and the prothorax is longer than wide, the axillae somewhat advanced. Lateral margins of abdomen carinate.

EPISTENIA SPECIOSISSIMA sp. nov.

Brilliant aeneus and finely punctate. Tegulae, legs (except a large blotch on ventral half, lateral aspect femur 3 between middle and apex, an annulus on tibia 3 less than its width from base and a lesser one same place tibia 2, also the aeneus proximal half of coxa 3) and basal half of scape, golden. Funicles 5–7 white. Somewhat resembles *Thaumasura pulchripes.* Forewing with infuscation as in *Thaumasura,* but the loop distinctly broken at middle and at base,

leaving the basal part an isolated, middle spot. Pedicel elongate, exceeding funicle 2, which is twice longer than wide, 1 wider than long, 8 quadrate, club exceeding pedicel. Postmarginal vein elongate, shorter than the marginal, over twice the stigmal.

Eyes densely pilose; prepectus finely punctulate; cheeks bordering genal suture glabrous; ocelli equidistant, lateral a bit closer to eye than to median.

Abdomen flat above, conical, exceeding thorax, last segment stylate and half as long as the ovipositor, which is ¼ abdomen, segments large, 6 largest, longer than wide, 3 very short, surface finely wrinkled or reticulated, 2 glabrous, 7 hairy.

Differs from *E. miripes:* Two marks on forewing, fore femur distinctly more swollen and distinctly excised beneath at apex, the basal end of the excision guarded by an acute tooth; funicle 5 is white (usually dark in other); fore leg usually without blotches (except on distal tibia beneath).

Queensl.: Kuranda, Nov. and Dec., 1919 (F. P. Dodd).

THAUMASURA Westwood.

THAUMASURA MARMORATIPENNIS sp. nov.

As *T. dentatitibia*, but hair of cheek sparse, short, short on back of vertex and on tibia 3; most of posterior margin of eye except above fringed densely with long, appressed silvery hairs. Eyes naked. Teeth above on tibia 3 pale. Scrobes not reaching, by far, to the cephalic ocellus (reaching to ocellus in other); clypeus glabrous (punctate in other). Ocelli equidistant from each other. Ovipositor ⅔ abdomen. Funicle red, joint 2 not quite as long as pedicel. Loop of wing distinct, complete, basal area as large as distal, latter with two hyaline crescents side by side in its middle. Funicle 8 longer than wide, shorter than club. Femur 1 excised beneath at apex, 3 convexly swollen. Hind tibial spurs short, equal.

Tarsi, bases of femora, knees 1–2, tibia 1 except beneath distad, 2 except not quite proximal half and distal ¼ except beneath, and tibia 3 at little over distal ½, golden. Propodeum with two large foveae at meson. Prepectus densely punctate. Thorax coppery, with dark velvety areas, four of these on scutellum. The male is very similar, but its propodeum is longer, and bears a median carina.

Queensl.: Kuranda, Dec. (F. P. Dodd). One female.

THAUMASURA PULCHRIPES sp. nov.

Ovipositor not extruded, abdomen nonstylate, 7 noncarinate. Scape and legs mostly pale whitish blotched with aeneus, funicles 3–5 whitish, also apex of

2 (and 4–6 slightly). Forewing with distinct loop, at each end of the loop the infuscation continued across the wing; apex of wing dusky. Discal cilia extended to base on cephalic half, but only after a wide space of nearly colourless cilia against submarginal; funicle 1 longer than wide, 2 not as long as the elongate pedicel. Club over twice the length of the distal funicle. Propodeum with median carina only, spiracle round, smaller than usual. Excision beneath at apex of femur 1 great. Hind tibial spurs small. Lateral ocelli closer to each other than either is distant from median.

Queensl.: Redland Bay, Feb., 1926. Two females from trunk of dead gums. Cotype in Queensland Museum.

THAUMASURA AURITEGULA sp. nov.

As *T. arenae* Girault, and small, the ovipositor somewhat more prominent; abdomen, however, brilliant coppery, and with golden (silver at base) fuzz along upper sides, conspicuous on 7 and dorsad there also. Wings clear.

Blue, legs except coxae and funicles 1–3 red. Funicle 1 longer than wide, 2 over twice longer than wide, but shorter than pedicel. Scrobes of the long, narrow, deep kind, and to median ocellus. Venation, tegulae golden.

Differs further from *T. arenae:* Propodeum short at meson, without a distinct carina there, spiracle not rounded, segment 7 bears a strong median carina, and femur 1 is excised beneath at apex.

Ocelli equidistant, lateral closer to eye than to median. Eyes pilose. Frons wide. No long hairs on head. Hind tibial spurs short, equal.

Queensl.: Nelson, Dec., 1919 (A. P. Dodd). One female.

THAUMASURA BELLA Girault.

Tasm.: Bridgeport (F. M. Littler, No. 2669).

This species differs from *T. brevistylus* in having only funicles 2–4 red, and the ovipositor is half the length of the abdomen, tibiae 1–2 aeneus above. The frons is wide.

There are two females in the Macleay Museum collection from South Australia.

THAUMASURA DENTATITIBIA sp. nov.

Hind tibia with a long, spiralled dorso-lateral ridge, which bears 4–5 stout teeth, the latter increasing in size. Hairs from caudal vertex long, black; those from tibiae 2–3 dorsad long, white; cheeks with long greyish hairs. Pattern of wing not solid. Eyes naked. Lateral ocelli closer than either is to median.

Ovipositor equal abdomen. Legs partly aeneus on femora and tibiae. Tegulae black, funicles 2–4 red, hind tibial spurs shorter and stout. Coxae aeneus.

Vict.: Mooroopna, Dec., 1923 (F. E. Wilson). One female; Queensl: Chinchilla (A. P. Dodd), cotype in Queensland Museum.

WESTWOODIANA Girault.

WESTWOODIANA PURPUREIPES sp. nov.

Differs from the genotype: Scape purple, ovipositor a bit longer, neck of stigmal vein equal to shortest diameter of knob. The same otherwise, but base femur 1, leg 2 except tarsi, knee and base widely of tibia and leg 3 except tarsi and base of tibia, purple.

Queensl.: Kuranda, Oct., 1919 (A. P. Dodd). A cotype female in Queensland Museum and two more from same source examined. Compared with type of the genotype.

SYSTOLOMORPHELLA Girault.

SYSTOLOMORPHELLA SILVIFILIA sp. nov.

Forewing with a cross stripe from stigmal vein and proximal half postmarginal, the stripe widening at middle. Club without spicule, merely obtusely pointed at apex; ring-joint present; scape clavate and roughly sculptured above at apex; extension of distal funicle not attaining apex club.

Antennae reddish, club black; more or less infuscation about bend of submarginal vein and opposite on caudal margin. Hind femur moderately swollen, serrulate beneath and slightly excised at apex; spiracle round, moderately large.

Lateral ocelli closer to eye than to median ocellus, but distinctly further apart than either is distant from median. Legs except coxae 3 and tegulae red.

Tasm. (A. Simson, No. 3407).

One female compared with types of all allied forms, from which it is separated by bearing unifasciate wings.

DINOURA Ashmead.

The antennae in this genus are 13-jointed, with two ring and three club joints. The axillae are much advanced, and the postmarginal and stigmal veins short, equal.

DINOURA PULCHRA sp. nov.

Characterized by the comparatively short ovipositor, which is only equal in length to the abdomen. Basal half of abdomen, more or less, red-yellow. Hind

femur red except basal half and distal sixth (in mesal aspect, however, with much more red, only extreme apex purple); tibia 3 white at base and apex; segments 2–5 of abdomen, except apex of 5, red.

S. Aust.: Adelaide (R. L. Barringer). One female.

There are five members of this genus.

EPISYSTOLE gen. nov.

Characterized by the teeth on the hind femur being as in *Chalcis*, by the pilose eyes, and the enlarged femur 1. Scrobes joined above, forming a triangle whose apex is distant from cephalic ocellus, latter thrice farther from lateral than they are from eye. Densely punctate and pilose. Meson propodeum widely long striate, a patch of silvery hair caudad of spiracle. Hairs longer from back of cheek and side of femur 1 and upper metapleurum.

Antennae 13-jointed, club with a long, conspicuous spicule which is more or less hooked at apex. Scape dilated below at apex; pedicel elongate, twice funicle 1, which is twice longer than wide. Ring-joint twice longer than wide.

The male is similar, but antennae aeneus, 3 equal segments abdomen, funicles shorter.

Entirely metallic; basal ¼ tibiae 3 ivory.

1. Funicles 1–3 dark red; an ivory spot at dorsal base tibiae 1–2; funicle 1 shorter than pedicel, twice longer than wide, or less. Joints 1–3 of tarsi 2–3, 1–2 of tarsus 1, white. Wings lightly infuscated from marginal and stigmal veins. Distal joint maxillary palpus sometimes white. Punctures of face coarser than those of vertex (genotype) .. *poeta* sp. nov.
2. Antennae all metallic, so tibiae 1–2; funicle 1 a little exceeding the pedicel, four times longer than wide. Larger. The same .. .. *meteora* sp nov.

The genotype was captured from the bark of a dead *Acacia*, Morningside, Queensland, Feb., 1926, and the types are in the Queensland Museum. The species *E. meteora* was captured at Chinchilla, Queensland (A. P. Dodd). The type is in the South Australian Museum. A paratype of the first species is also in the last-mentioned Museum.

SUB-FAMILY PERILAMPINAE.

PERILAMPUS Latreille.

PERILAMPUS BRISBANENSIS Girault.

Tasm.: Hillwood, Feb., 1915 (F. M. Littler, No. 2637). One female.

PERILAMPUS CAPENSIS Girault.

A female, Meadows, S. Aust.

The sculpture of segment 3 of abdomen is not a glaze, since the puncturation has spaces between.

PERILAMPUS AQUILONARIS Girault.

A female, Melrose, S. Aust., Oct. (A. M. Lea).

Segment 3 of abdomen bears 3 rows of pale hairs. Differs from *P. saleius* Walker in its pale venation, red flagellum (minus pedicel), longer stigmal vein, the more sculptured mesal margin of parapside and the pale tegulae. The abdomen is green, and the thorax is bronze-brassy.

I have the species *P. saleius* Walker from Queensland, where it was reared in connection with a lepidopterous pest of cotton, Biloela, Queensl. (E. Ballard).

PERILAMPUS CUPREOVARIUS sp. nov.

Head with upper half of face coarsely striate, lower entirely densely punctate (except sclerite between clypeus and antennae); cheeks and occiput striate. Tibiae concolorous. Median ocellus a bit advanced, at apex of scrobes, slightly closer to lateral than latter is to eye. Scutellum emarginate at apex.

Coppery, segment 3 green, venation black, knees, tibial tips (both narrowly) and tarsi red. Postmarginal shorter than marginal. Parapside all punctate, except a small glazed area, cephalad of middle. Segment 2 $\frac{1}{3}$ surface, cephalic, glabrous, 3 largest, densely glazed, pin-punctulate, nearly rest of surface, its apex shining coppery; 4 short, glazed, brilliant coppery at apex, prepectus glazed. A long, feebly cross-striate area across middle of mesopleurum (down from beneath tegula). Propodeum densely punctate laterad (margin to spiracle). Facial margin eye fringed with lashes, these short.

Tibia 1 reddish along one side at apex.

S. Aust.: Melrose, Oct. (A. M. Lea). Type female. Cotype female, S. Aust. (Rev. A. P. Burgess, No. 1792). Paratype female, Tasm. (A. Simson, No. 2709). The cotype has been deposited in the Queensland Museum.

SYSTOLOMORPHA Ashmead.

SYSTOLOMORPHA THYRIDOPTERYGIS Ashmead.

Many pairs from galls on *Casuarina quadrivalvis*. S. Aust.: Belair, Sep., 1885 (J. G. O. Tepper).

This species differs from *S. nassaui* mainly in that the legs have more black, the hind femora always black to apex, and femur 1 is always widely black from

base. The flagellum is more brownish. The wings are usually hyaline, but may bear a cloud, as in *S. nassaui*. However, the two species are easily separated by the colour of the oral cavity and palpi, yellow in this species, and black in *S. nassaui*.

Very likely this species has no connection with the insect after which it is named. The species is one of the gall-forming Perilampinae, and *S. nassaui* was also reared from galls on the same genus of plants. Both species vary in colour and infuscation of the wing.

EURYTOMOMMA Girault.

EURYTOMOMMA ATRICOXA sp. nov.

As the genotype, but venation black and the distal veins less unequal (stigmal and postmarginal, latter distinctly shorter than marginal, yet of good length); cheeks and entire margins eye golden (all of head so, except occiput and vertex). Funicles gradually increasing in size from the smallest (ring-joint) to the largest (8), latter much wider than long; legs marked with black streaks along cephalo-dorsal aspect of femora 1–2 and basal $\frac{2}{3}$ of mesal aspect of femur 3; first five flagellar joints of antennae except apex of pedicel, blackish, distad only suffused yellow, scape lemon.

Thorax: Pronotum lemon; distal $\frac{1}{3}$ parapside, cephalic half lateral margin scutum, middle lateral margin scutellum and of caudal margin axilla, post-scutellum, golden.

Minute punctures all over lower face; no median carina on scutellum, but one on propodeum, which forks at middle, and a lateral sulcus instead of lateral carina, spiracle oval.

Lateral ocellus twice closer to eye than to median. Tibiae armed above with short and stiff spines.

S. Aust.: Ooldea (A. M. Lea). One female.

SUB-FAMILY EURYTOMINAE.

EURYTOMA DESCARTESI Girault.

A female, Gawler, S. Aust. (A. M. Lea).

This is a widely distributed species in eastern Australia.

EURYTOMA SEMIFUSCICORNIS Girault.

Many females and one male reared from *Doratifera longerans*, Nov., 1891, Adelaide.

EURYTOMA EYLANDTI sp. nov.

Runs to *E. nelsonia* and allies. Abdomen ovate, rounded above, petiole wider than long, entirely blood-red, except petiole and apex (distal ⅔ of 7). Femur 3 blood-red. Flavous of propleurum upper half cephalic margin (rather widely). Legs and antennae black, except base of scape, knees, tibial tips, base tibia 3, tibia 1 (except a mark on one side near base, rest red, paler above and at tip), femur 1 beneath, these dark red or paler (tarsi and apex of tibiae white). Forewing with a brown half-complete cross stripe from marginal and stigmal veins.

Lateral ocellus midway between median and eye. Tegulae dark red. Venation brown, postmarginal shorter than marginal, exceeding stigmal. Segment 5 longest, but not much longer than either of 2–4, abdomen reticulated. Propleurum finely reticulate, femoral furrow cross-striate. Funicle 1 thrice longer than wide, much exceeding the short pedicel. Coxa 3 above with a distinct triangular tooth near apex. Moderately robust.

N. Terr.: Groote Eylandt (N. B. Tindale).

EURYTOMA SILVIPUER sp. nov.

In my table of Australian species follows *E. cressoni limoni* Girault under the heading "Legs red except coxa 3." Tarsi, tibial tips, knees, pale.

The same, but median basin of propodeum rather flat, triangular, bounded by an oblique carina on each side of meson (from half-way to spiracle and converging to apex), two shallow foveae at base, and no channel; fine, wrinkled rugae run through the area, with interspaces punctulate. Apex pedicel, scape, tegulae, and venation yellow-red.

Abdomen red except 2–4 dorsad, tip and segment 7 except base, acutely ovate, segment 5 over twice 4, distinctly largest. Femoral furrow punctulate. Postmarginal vein exceeding the stigmal. Funicle 1 exceeding the small pedicel, but only a bit longer than wide. Lateral ocellus distinctly closer to eye than to median. Pubescence rather abundant and noticeable. Otherwise usual.

S. Aust.: Mount Lofty (A. M. Lea). One female.

EURYTOMA SALTINATUS sp. nov.

Runs to *E. dumasi*, but coxae 1–2 yellow-red. Moderately robust. Propodeum with an almost rectangular, finely punctulate median basin, petiole short, venation yellow, postmarginal a bit exceeding stigmal, both shorter than marginal. Funicle 1 quadrate, much exceeding the globular pedicel, 2 wider; scutellum with distinct, scattered pubescence, the punctures wider apart than usual.

Antennae, ovipositor except tip, tegulae, legs except coxa 3, red-brown.

Segment 5 equals 2–4 united, abdomen ovate, pointed at apex. Lateral ocellus closer to eye than to median. Propleurum, femoral furrow, punctulate. Tarsi white.

S. Aust.: Mount Pleasant, Feb., 1896. Two females from lerp galls.

EURYTOMA FILISILVAE sp. nov.

As *E. aequalivena* Girault, but legs red except coxae and femur 3, antennae short, clavate, funicle 1 subquadrate, exceeding pedicel, rest wider than long, scape red-yellow except above for distal $\frac{3}{4}$ or except base, club (and often distal funicles) yellowish. Petiole longer than wide, segment 5 equals 2–4 united, shining, with a cross-row of short setae just beyond middle, 5 over twice 4. Postmarginal slightly exceeding stigmal. Femoral furrow punctulate. Lateral ocellus a bit closer to eye than to median.

(Channel unifoveate. Propleural spot slightly visible from above. Venation yellow. Abdomen ovate. Tegulae dark.)

S. Aust.: Mount Pleasant. Many females with *E. saltinatus*.

DECATOMA Spinola.

I consider *Eudecatoma* Ashmead to be the same as this genus.

DECATOMA SIDNICA sp. nov.

Differs from *D. persephone* (described later) as follows: Smaller, body all black except cephalic margin prothorax; mesal area of propodeum not rugulose, much smaller but of same shape (its sides are short and nearly straight, oblique), it does not attain apex, but ends obtusely before apex, giving off a perpendicular carina to apex from each side of *its* apex; the carina forming its base (two oblique sides), is continued to the spiracle, and a lateral carina is given off from it near the spiracle; the surface of the propodeum is much smoother; the abdomen is only suffused with yellowish. From *D. medioimpunctus:* In colour, in having the apex margin (here obtuse apex) of mesal area of propodeum much shorter than the basal; the substigmal spot nearly reaches centre of the wing.

Legs except coxa 3 and femur 3, tibia 2–3, antennae, yellow-brown. Scutum except cephalad, scutellum except median line and pronotum umbilicately punctate.

N.S. Wales: Sydney (A. J. Coates). A female reared from Port Jackson fig *(Ficus rubiginosus).*

DECATOMA PERSEPHONE sp. nov.

As *D. medioimpunctus,* but wing marking longer, cheeks except above, face down from antennae, vertex and pleurum of thorax (save latter above), abdomen

except 6 (suffused yellow), petiole, propodeum, hind legs except tarsi, tibial tips and knees, coxae 1–2, and more or less of leg 2, black. Segment 5 somewhat exceeding 4. The lateral margin of mesal area leaves base mesad of the spiracle and is straight; the apical margin is shorter than the basal. Smoother median line of scutellum wider, not markedly distinct.

Queensl.: Bowen, Nov. (H. Tryon). Types, two females reared from *Ficus* fruit. Cotypes in Queensland Museum.

SUB-FAMILY CHALCIDINAE.

CHALCIS Latreille.

CHALCIS RUSKINI Girault.

Two females, Mount Lofty; a third at Ardrossan, S. Aust. (J. G. O. Tepper).

CHALCIS REGINA Girault.

A female, Lucindale, S. Aust. (B. A. Feuerheerdt); two females, Bowen, Queensl. (A. Simson, No. 2272).

CHALCIS POMONAE Cameron, EDNA var. nov.

Like the typical form, but tibia 3 black at base, tibia 1 narrowly yellow along one cephalic aspect. Black cinctus of tibia 3 about equal distal yellow, basal yellow barely shorter and much exceeding black at base. Tibia 3 black at base.

S. Aust.: Adelaide (J. G. O. Tepper). Two females.

CHALCIS RUBRIPES Girault.

A female, Launceston, Tasm., Feb., 1914 (F. M. Littler, No. 2668).

CHALCIS RUBRIPES VERGILII Girault.

A male and female, Launceston, Tasm., Feb., 1911, No. 2255 (F. M. Littler). In the male, tibia 1 dorsad was entirely black.

CHALCIS CALLIPHORAE Froggatt & Froggatt.

A male, Ardrossan, S. Aust. (J. G. O. Tepper).

CHALCIS CALLIPHORAE SANGUINIVENTRIS Girault.

Differs from the typical form in having tibiae 1–2 red, 2 black above. Apical ¼ femora 1–2 golden, red of tibia 3 much exceeding golden at base and apex.

There were one male and three females in the collection from Adelaide (J. G. O. Tepper).

CHALCIS JUNO sp. nov.

Runs to *C. minerva* (described later), but tibia 3 black, so tarsus 3. Leg 1 except coxa and base of femur, 2 except base of femora and all of tibia 2 except each end, red. Tegula yellow, abdomen beneath red, so coxa 3. Tibia 3 suffused with red. Eight femoral teeth, 1, 5–7 largest.

S. Aust.: Owieandana, Northern Flinders Range (H. M. Hale and N. B. Tindale). The type specimen only.

CHALCIS MINERVA sp. nov.

Runs to *C. dipterophaga,* but hind tibia all black except for a dull yellow ellipse, this long, at apex above; leg 1 except coxa, proximal half femur and base of tarsus, knees 1–2, each end and beneath narrowly, tibia 2, tarsus 2 except at base, dull golden. Femur 3 all red. Tegula yellow. Abdomen beneath more or less red, also entire side of 2. Segment 3 densely punctate dorso-laterad, 3–4 of the lines joined across meson on cephalic half, rest of dorsum beyond densely pin-punctate.

S. Aust.: Owieandana, Northern Flinders Range (H. M. Hale and N. B. Tindale). Two females.

CHALCIS SCHUBERTI Girault, MARIANA var. nov.

As typical form, but tegulae all yellow, basal yellow spot tibia 3 distinctly exceeding basal black, the distal long and to apex. Punctures scutellum uniform; segments 4–6 also red except on dorsal meson widely; abdomen red beneath.

S. Aust.: Port Augusta, Dec., 1904 (M. Schultz). One female.

CHALCIS RUFICORNIS Girault.

A female, Bowen, Queensl. (A. Simson, 1940/4681).

CHALCIS PUELLA sp. nov.

Follows *C. shellyi.* Legs and tegulae golden but coxae black, femur 3 and base narrowly of tibia 3 above, red; apex femur 3 at distal $\frac{1}{3}$ (lateral aspect) except narrowly dorsad, yellow. Punctures scutellum coarser than those of scutum. Lateral ocelli closer to eye than to median. Extreme base of femur 1, basal half femur 2, red. Normal.

Queensl.: Kuranda (A. P. Dodd). Type and paratypes in South Australian Museum, one female, one male, and two females respectively. Cotype and paratypes in Queensland Museum.

CHALCIS ALIGHEREI sp. nov.

To follow *C. aureus*. Black, with a distinct pubescence which is yellowish in places; the following crimson: Scape, tegulae, tibiae, femur 3, distal ⅓ femur 1, apex femur 2. The following golden: Tarsi 1, knees, apex upper side femur 3, two spots above on tibia 3, basal much exceeding red proximad of it, distal at apex. Tarsi 2–3 white. Rest of legs black, including middle narrowly of ventral edge of side of tibia 3. Hind femur with 10 teeth, 2 and last two smallest. Ventral meson abdomen more or less reddish, segment 2 glabrous. Middle red tibia 3 exceeding basal yellow. Lateral ocellus somewhat closer to eye. Small species.

Queensl.: Nelson, Dec., 1920 (A. P. Dodd). One female.

CHALCIS POEMA sp. nov.

Black, the following golden: Tegulae, tibiae, tarsi, knees, distal ⅔ femur 1, distal ⅓ femur 2; in lateral aspect, extreme base (except dorsad) of femur 3, distal ⅕ of same. The following dark red: Upper side more or less of segment 2, lower sides more or less of rest, all of mesal aspect of femur 3 except the distal yellow and central black; of lateral aspect femur 3, all dorsad to the distal yellow, and around the black to the narrow basal yellow. On femur 3 lateral aspect a large rounded black area at middle from ventral edge up ⅚ way to dorsal edge (this area smaller on mesal aspect). Normal. A dozen femoral teeth. Segment 3 with 4–5 lines distinct thimble punctures across meson.

Queensl.: Nelson, May, 1920. Type female. Cotype from maize, Cairns (A. P. Dodd).

PHASGONOPHORA Kirby.

PHASGONOPHORA MILTONI sp. nov.

Scutellum with an entire plate at apex. As *Xenarretocera* genotype, but femur 3 with (7) large teeth, postmarginal and stigmal veins distinct, stigmal with knob and longer, abdomen at apex produced into a short, compressed, punctate, hairy, subquadrate (lateral aspect) stylus. Antennae at middle of face.

Black with yellow pubescence, but this is not profuse; tegula, tarsi, tibia 1, 2 save above proximal ⅓, mesal aspect femur 2, apex of femur 3, distal ⅓ tibia 3, golden-red; distal ⅙ forewing smoky; from this runs a midlongitudinal arm,

expanding into an arrow-head, which is appended from stigmal knob; cephalic margin also infuscated from postmarginal vein distad; apex wing 2 infuscated.

Punctate. Lateral ocellus much closer to median than to eye. Funicle 1 somewhat longer than wide, much exceeding the cup-shaped pedicel, the ring-joint large but smaller than pedicel. Abdomen truncate and carinate across base, also at lateral margin at base; segment 2 half surface. Propodeum rugulose, a coarse pair of median rugae.

The male is similar, but the antennae are filiform, funicles longer.

Neither of the two Australian members of this genus has any marked propodeal prominences; they agree in all essential details, differing in colour, and greatly in the length of the abdominal stylus. The flagellar joints are not long.

Queensl.: Kuranda, Nov., 1919 (A. P. Dodd). Type, a pair. A cotype female in Dec., same place, in the Queensland Museum.

The species *P. rufinotum* was formerly placed in *Megalocolus*.

METARRETOCERA gen. nov. (Haltichellini).

As *Xenarretocera* genotype but facial margin of eye distinctly carinated as in *Stomatoceras*, segment 2 glabrous, $\frac{1}{3}$ plus surface, with four carinae at base, one each side of meson (wide apart), others at lateral margin, all short ($\frac{1}{4}$ length of the segment); other segments short but 7–8 longer. Postmarginal slight. Scutellum simple.

METARRETOCERA BURNSI sp. nov.

Black, the wings deep brown except costal cell and longitudinal streaks; knees 1–2, tarsi, tibial tips, apex scape, pedicel, and the short funicle 1, red-brown; distal $\frac{1}{3}$ wing 2 dusky. Funicle 2 equal pedicel, longest, half longer than wide; lateral ocellus at apex facial carina, closer to eye than to median.

Punctate, coarser on scutellum. Propodeum with six longitudinal rugae, two median, others interlacing. Teeth hind femur on about distal half, on a long, slight convexity. Pubescence not great.

Queensl.: Nelson, Oct., 1920 (A. P. Dodd). Two females.

XENARRETOCERA Girault.

This genus belongs to the Haltichellini.

XENARRETOCERA TRICARINATA sp. nov.

Legs except coxae red. Tegulae black. Segment 2 half surface, 3 large but not half of 2, latter at base with three straight carinae along about basal $\frac{1}{3}$, one

at meson, others not quite at lateral margin (latter carinated at base). Antennae red, club darker. Wings clear.

Femoral teeth commencing at distal ¼ in an acute point, then to apex in a concave line. Abdomen above finely reticulated, more coarsely proximad. Funicles subquadrate. Lateral ocellus a bit closer median than to eye.

Queensl.: Nelson., Oct. and Dec., 1920 (A. P. Dodd). Two females, type and paratype.

PARENIACA Crawford.

PARENIACA EMERSONI sp. nov.

Abdomen without fine, close striae above at base, but with three short, well-separated carinae on each side of meson. Lateral margin propodeum "bidentate." Propodeum with a pair of curved median rugae which join well before apex, and a long, strong ruga between these and the carinated, irregular lateral margin. Petiole usually longer than wide, with six coarse rugae. Pedicel subelongate, exceeding funicles, of which 1 is smallest, rest more or less quadrate. Wings lightly embrowned. Lateral ocelli distinctly closer to eye than to each other. Postmarginal absent, knob of stigmal sessile and nearly parallel with costa. Area of carinae on segment 2 much wider than long. Scutellum uniformly punctate.

Antennae, legs 1–2 save coxae and middle lateral aspect femur 1, tarsi, red. Pubescence golden. Distal funicles wider than long.

A species showing considerable variation in length of petiole and in *number* of striae or carinae at base of segment 2.

Queensl.: Babinda, Feb., 1920 (A. P. Dodd). Type female; cotype female, Nelson, Jan., 1920 (same collector).

PARENIACA ATRICORNIS sp. nov.

Striae of abdomen at base, 8, the area quadrate, its distal margin a bit concave and far before middle, segment 2 nearly the whole surface. Wings slightly dusky. Disk of scutellum with a glabrous area. Tegulae, legs, and antennae black except tarsi, knees 1–2 narrowly, tibial tips 1–2. Two teeth beneath in front coxa 3. Lateral ocelli slightly closer to each other than to eye, yet closer to median. Pubescence grey. Petiole quadrate. Propodeum as in *P. boussingaulti*, and the carinated lateral margin is subparallel with the long lateral carina. The short carina from "circle" of median carina to the lateral carina originates a bit distad of the centre of the "circle," which is oval. Apex pedicel, of scape (rarely flagellum more or less), reddish.

S. Aust.: Adelaide (A. M. Lea). From females reared from striatiomyiid-like larvae. Paratypes in Queensland Museum.

STOMATOCERAS Kirby.

STOMATOCERAS CARLYLEI Girault, SALTI var. nov.

As description of the typical form, but of pedicel only apex, red, tegulae all red, and coxa 1 is black; rectangle from marginal vein produced into the disc, and therefore nearly as long at longest point as wide (or nearly as deep as wide). Segment 2 $\frac{1}{3}$ surface. Teeth hind femur on about distal half in two crenulations, the first the shorter.

Male, antennae all black, so segments 3–4 above, wings clear. The same as female elsewise. Small.

Coxa 1 is invariably black in all species of the genus, and it is segment 7 of the abdomen which is rugoso-punctate (not 8).

S. Aust.: Mount Lofty (J. G. O. Tepper). Two males, six females.

STOMATOCERAS SALTENSIS sp. nov.

As *S. fasciatipennis* Bingham, but a distinct space exists between the eye and the acute margin of the scrobes, the postmarginal distinctly exceeds the marginal, and the stylus is twice longer than wide. Moreover, the tegula is black except at apex, and funicle 1 is shorter than the pedicel but distinctly longer than wide.

Lateral ocelli not twice closer to eye than to median. Femoral teeth on first a long, slightly wavy line, then a short, distinct convexity.

Tasm.: Georgetown, Nov., 1914 (F. M. Littler, No. 2668). One female.

STOMATOCERAS LUCI sp. nov.

Runs to *S. ratzeburgei*, but distal $\frac{1}{2}$ abdomen 2 above, 3 and base of 4, tegulae, legs except coxa 1, first 4 antennals, red. Loop of forewing complete. Funicle 1 quadrate, 2 equal pedicel. Lateral ocellus twice closer to eye. Postmarginal vein slightly exceeding the marginal. Teeth of femur 3 on distal $\frac{2}{3}$, two equal parts, first nearly straight, second a distinct convexity.

W. Aust.: Mullewa (Miss J. F. May). One female.

Colouration appears to be the specific characteristic in this genus, which, like *Chalcis*, is rich in species; many of these are difficult to define.

CHALCIDELLIA Girault.

CHALCIDELLIA GUTTATIPENNIS sp. nov.

Black, veins black, the forewing with a large blackish mark from distal half marginal vein, postmarginal and stigmal; this extends half-way across, and then

becomes diffused to hind margin (for a distance in either direction). Flagellum except pedicel and club, red, also sides and venter of abdomen more or less, tarsi, knees, and tibial tips narrowly.

Differs from genotype also in the following particulars: Funicle 1 is somewhat shorter, also the abdomen, the pubescence is more distinct, especially on lateral pronotum, where it is visible and golden.

The scutum in both species is spinose cephalad.

Queensl.: Kuranda, Nov. (A. P. Dodd), from tree trunks. Three females from tree trunks; type, cotype, and paratype.

IRICHOHALTICHELLA Cameron.

This is a very distinct group, in spite of what I have published to the contrary. The following species have been found in the collections of the South Australian Museum, and are tabulated with the two species already known. The antennae are 11-jointed.

I. Segment 2 distinctly over half the surface and over thrice longer than 3 (dorsal aspect at meson).

a. °Femur 3 red. Antennae black. Tibiae red. Wings clear. Segment 3 much convexed at apex. Coxae and basal $\frac{2}{3}$ femora 1–2, tegulae save distal edge, black .. .. .. *pilosella* Cameron

aa. °Femur 3 black except mesad; scape, pedicel red. Tibia 1 red, 3 black, 2 so at base. Wings smoky. Segment 3 only somewhat convex at apex, reticulated dorsad. Eyes naked. Base of femora, femur 2, tarsi, mesal aspect except dorsad at distal $\frac{1}{2}$ of femur 3, knees, tips tibiae, red. Funicles 2–3 half longer than wide, not as long as pedicel .. .. *multistriata* Girault

II. Segment 2 not quite $\frac{1}{2}$ surface, 3 over half 2 (or less and deeply concaved).

b. °Segment 3 with apical margin slightly concave, surface densely pin-punctate. Femur 3 black, antennae black; tibiae, tarsi, knees, tegulae red. Wings smoky (light). Thorax pilose. Eyes hairy. Coxae, femora 1–2 save ends, black; apical pedicel red; funicle 1 wider than long, 2 quadrate. Punctures scutellum much coarser

than those of cephalic scutum. Segment 3 dorsad, nearly entirely densely pin-punctate. Lateral ocellus midway between eye and median. Lateral margin propodeum strongly bidentate.. *silvae* sp nov.

bb. Segment 3 with apical margin deeply concave, surface glabrous with scattered punctures, dense laterad (and widely so on apex). Wings almost black, tegulae black. Eyes naked. Funicles and pedicel longer. Thorax shining, hairs longish. Twice larger. Tibiae save red ends, black. Legs black, knees, tibiae reddish. Segment 4 glabrous, hairs just before apical edge. Striae segment 2 coarse .. .. *silvifilia* sp. nov.

IRICHOHALTICHELLA SILVAE Girault.

S. Aust.: Mount Lofty Range (N. B. Tindale). The type is a female.

IRICHOHALTICHELLA SILVIFILIA Girault.

N.S. Wales: Liverpool (A. M. Lea). A single female.

CHALCITELLOIDES Girault.

CHALCITELLOIDES IO Girault.

S. Aust.: Mount Lofty Range (N. B. Tindale). A female.
Coxa 2 was red-brown and the petiole more or less reddish beneath.

SUB-FAMILY CALLIMOMINAE.

MACRODONTOMERUS Girault.

MACRODONTOMERUS TRIANGULARIS Girault.

This is a very common species, and the following specimens have been identified from this collection:

Single females, Mount Lofty (J. G. O. Tepper), Tarcoola; five females by use of the sweep-net, Mount Lofty, S. Aust. (A. M. Lea); Tasmania, two fragments and one from same locality.

MACRODONTOMERUS ALIGHERINI sp. nov.

Scape yellow except above. As *M. triangularis,* but sculpture more rough and pilosity of head and upper thorax much more evident; femur 1 usually widely yellow dorsad apically.

Type a female, Macleay Museum, labelled, "Sydney, N.S. Wales." Three cotypes in Macleay Museum same locality, and paratypes in Queensland Museum and South Australian Museum.

In the South Australian Museum collection were also seven females, Melrose, S. Aust., Oct. (A. M. Lea), and these are designated paratypes.

DITROPINOTELLA Girault.

DITROPINOTELLA COMPRESSIVENTRIS Girault.

The following specimens of this common species: A female, Adelaide, May 5, 1913 (H. H. D. Griffith), and another reared from galls or lerp, Mount Pleasant, S. Aust. (Loveday), Feb., 1897.

In the first specimen femur 3 bore some metallic.

PODAGRIONELLA Girault.

PODAGRIONELLA SPILOPTERION Cameron.

Three females, Launceston, Tasm., Nov., 1914 (F. M. Littler, No. 2283). The segmentation of the club is distinct.

PODAGRIONELLA JULIA sp. nov.

Wings hyaline. Ovipositor twice the length of the body.

Coxae, femur 3, tibia 3, femur 2 laterad, femur 1 above more or less, aeneus. Flagellum black, scape rufous, aeneus at apical ½. Abdomen with segments 2–4, apex widely of 5 (latter long, equal 2–4 united) and 7 and 8 (or distal 2) at sides beneath, reddish or rosaceous (the basal red equals middle aeneus or nearly). Cross-suture scutellum very distinct, glabrous distad of it. Apex tibia 3 normal, 1–2 of tarsus 3 equal, longest. Funicle 1 quadrate, shorter than pedicel, 7 distinctly wider than long. Postmarginal twice the stigmal. Lateral ocellus closer to eye, thrice closer to it than to median and farther apart than each is from median. Propodeum with meson widely foveate, rest finely punctate-scaly, foveate part terminating beyond middle in a sort of cross ridge.

S. Aust.: Adelaide (N. B. Tindale). By sweeping.

MEGASTIGMUS Dalman.

MEGASTIGMUS QUADRISETAE sp. nov.

Scutellum with four bristles, 1–3 equidistant, 4 half closer to 3 (No. 3 absent on one side); no cross-suture. Ovipositor ¾ body. Thorax with a wide median stripe to apex scutellum, wider on scutellum. Antennae black except scape and

pedicel beneath somewhat, club a bit yellowish. Funicle 1 half longer than wide, exceeding pedicel; last subquadrate.

Flavous; scutum, scutellum, and mesopleurum orange, the following black: Upper occiput, ocellar area widely, cephalic margin scutum except lateral corner, thorax surrounding axillae, dorsal sutures, thoracic venter, propodeum nearly to spiracle and its spiracular sulcus and dorso-lateral sulcus (continued in a wide stripe down cephalo-lateral aspect of coxa 3); cephalic margin mesopleurum, a stripe along middle of side of femur 1, and an elongate mark on distal middle side of femur 3. Abdomen with conspicuous jet encircling bands, fainter beneath (6, these equally distributed over the surface, 1 and 2 near base, dorsal and more or less suffused). Ocelli in a curved line. Jaws tridentate. Sculpture of scutum fine.

Tasm.: Cradle Mountain (H. J. Carter and A. M. Lea). One female.

MEGASTIGMUS SEXSETAE sp. nov.

Scutellum with six bristles (on one side only 4, 1 and 6 absent), with the exception of 2–3, nearly equally spaced, 6 just beyond a distinct cross-suture. Jaws bidentate, 2 widely truncate. Cross-striation of scutum ruder than usual, and there is a single slender, fine bristle on disk caudad towards meson and nearer middle than to apex. Ocelli in a curved line. Ovipositor equal body. Funicle 1 longer than wide, exceeding pedicel distinctly.

Orange, caudal margin pronotum *widely* and much of face lemon. Black: Antennae except scape (except above), pedicel beneath, upper occiput, ocellar area narrowly, spot at side neck prothorax, suture between pro- and mesopleurum, a triangle on prosternum (lines only), rest of sternum, notum laterad of scutellum and axillae including lateral margin of latter, propodeum to spiracle and nearly to apex; apex segment 2 widely, 3–7 widely except apex of each.

Tasm.: Launceston, Dec., 1915 (F. M. Littler).

NEOMEGASTIGMUS Girault.

NEOMEGASTIGMUS ATER sp. nov.

Similar to *N. poeta*, but the ovipositor nearly as long as body, and the antennae are suffused with yellow, the cheeks, face to mouth, venter and apex abdomen (and base more or less), golden; also coxae 1–2. Funicle 1 a bit longer than wide, equal pedicel. Lateral ocellus midway between eye and median; hind femur with faint, outer middle blotch. Propodeum without median carina, or this very weak. Last two bristles (2 and 3) of scutellum closer together. Scutum without discal setae, finely cross-striate.

Male black except orbits on vertex, hind margin pronotum, mesal margin

axilla, tibiae, tarsi, most of femora (sometimes as female, and even with pronotum, caudal scutum and disc scutellum yellow). The male coxa 3 may even be yellow in variations toward yellow.

S. Aust.: Blakiston.

From specimens labelled "From galls on leaves of *Eucalyptus obliqua*, April, 1888. Emerged in May, Smeaton."

PSEUDIDARNES gen. nov. (Idarnini).

Antennae in middle of face, 13-jointed, 2 ring-, 3 club-joints; jaws 3-dentate, 3, truncate, wide, but not very wide; clypeus with two wide (wider than long), truncate teeth at meson; lateral ocelli distinctly closer to eye than to median, not near eye; marginal vein more or less ¼ submarginal, somewhat exceeding the long postmarginal, which is a bit shorter than the well-developed, curved stigmal. Parapsidal furrows complete, distinct. Scutellum with a lateral groove, truncated behind by a line of foveae, subquadrate, and a bit convex. Propodeum with a median carina, convex, spiracle minute, round. Petiole quadrate, 2 ⅓ surface, longest, ovipositor as long as body. Hind tibial spurs double, unequal, larger spur curved. Abdomen ovate, no longer than thorax.

A genus characterized by the distinctly petiolate abdomen and the shortness of the latter.

PSEUDIDARNES MINERVA sp. nov.

Aeneus, scaly, wings clear, veins brown; scape, tip tibia 3, other tibiae, knees, tarsi, dull yellow. Funicles short, 1 quadrate, exceeding the pedicel, rest a bit shorter. Scape short, equal short club. Joint 1 of tarsus 3, elongate, half the tarsus. Mesopleurum with a deep, oblique cross-suture through it, dorso-ventrad. Abdomen somewhat compressed. Discal cilia absent proximad of base of marginal vein.

N.S. Wales: Sydney (A. J. Coates). A female from *Ficus rubiginosus*.

KOEBELEA Girault.

KOEBELEA FUSCA Girault.

Two females, Cairns district (A. M. Lea).

KOEBELEA FUSCA Girault, FLAVA var. nov.

The same as the typical form, but light yellow, no mark on axilla, and only the first three stripes are present upon the abdomen, and these are abbreviated (across meson only). The scutellum appears a bit shorter.

N. Terr.: Roper River (N. B. Tindale). A female reared with *Blastophaga niecipes* from *Ficus glomeratus*.

GONIOGASTRELLA Girault.

GONIOGASTRELLA CAUDATA Girault.

A female, Cairns district, Queensl. (A. M. Lea). Another reared from *Ficus glomeratus*, Roper River, N. Terr. (N. B. Tindale). Associated with *Blastophaga niveipes*.

SUB-FAMILY PTEROMALINAE.

ORMYROMORPHA Girault.

ORMYROMORPHA TRIFASCIATA Girault.

A female, Hughes; also three from Melrose, S. Aust., Oct. (A. M. Lea).

ORMYROMORPHA SILVIFILIA sp. nov.

The following description is extracted from my table of species of this genus: "Scutum and scutellum with only two setae, the distal pair of scutellum. As *petiolata*, but petiole only ⅓ length of propodeum, a bit wider than long. Larger, hyaline cross-stripe narrower than usual, 2 barely exceeding distal dark stripe, 1 wider than 2 and greatly curved, due to the unusual conical projection of the hind margin of dark stripe 1; the cephalic curve of this is longer and wider than the caudal; moreover, hyaline 2 is just beyond apex stigmal, not at it. Fringes usual. Hind wing widely dusky at apex. Size usual, stout. Funicles 1–2 subequal.

Lateral ocellus nearly twice closer to eye than to median; abdomen 2 without dorsal pilosity. Propodeum with longitudinal rugae. Pilosity of scutellum at base only. Tibia 1 except sides, tarsi 1–2, yellow-brown, so flagellum, scape so at distal ½ or less."

N.S. Wales: Dorrigo. One female.

ORMYROMORPHA AENEISCAPUS sp. nov.

As *O. trifasciatipennis*, but antennae entirely metallic, (distal) bristles of scutellum (on suture) with a distinct seta behind it. Hyaline 1 exceeding 2 and much exceeding fuscous stripe 1.

S. Aust.: Kangaroo Island (A. M. Lea). One female.

TOMOCERA Howard.

TOMOCERA VIRIDIVERTEX sp. nov.

This description is taken from the table of species:

"Apical margin forewing clear; postmarginal shorter than stigmal. Hairs of scutum long, bristles; abdomen green. Postmarginal much shorter than stigmal. As *T. glabriventris*, but vertex and clypeus metallic; forewing with two fuscous marks, 1 across from base of marginal vein, 2 half across from apex stigmal;

No. 1 is straight. Funicle above, pedicel above, club black. Lateral ocellus midway between eye and median. Legs and other parts head red-brown."

S. Aust.: Melrose, Oct. (A. M. Lea). Two females.

TOMOCERA GLABRIVENTRIS Girault.

A female, Cornwallis Island, Torres Straits (C. T. McNamara).

OPHELOSIA Riley.

OPHELOSIA ALIGHERINI sp. nov.

Description taken from table of species: "Thorax above nonmetallic or only washed with metallic. Funicle pale or dark in part only. Thorax washed with metallic in places. Abdomen yellow, darker above beyond the long segment 2; club yellow at basal ⅓; bristles of scutellum pale; second cross-stripe barely touching marginal. Red-brown, scutum washed metallic. Funicles 1–2 and pedicel above, black."

Tasm.: Waratah (A. M. Lea and H. J. Carter). One female.

OPHELOSIA CRAWFORDI Riley.

Three females reared from a white-fluffy coccid, Launceston, Tasm. (F. M. Littler, No. 2383).

OPHELOSIA KEATSI sp. nov.

Runs to *O. viridithorax*, but head except ocellar area, prothorax except notum, sides and ventum thorax, legs, scape, abdomen beneath, segment 2 above except spots at middle and apex of margins, base and apex, reddish-yellow. Flagellum black. Scutum pilose, scutellum glabrous or nearly, with four bristles, axilla with one laterad. Forewing with a large, fuscous area from the whole of stigmal and distal part of marginal, this projecting distad of the vein. A narrow stripe across from bend of submarginal vein. Postmarginal equal stigmal. Propodeum longitudinally rugulose.

S. Aust.: Hughes (A. M. Lea).

PSEUDIPARELLA gen. nov. (Diparini).

Habitus of *Lelaps*, but hind tibial spur single, short. Antennae in middle of face, 11-jointed, with a short ring-joint and a solid club; jaws 3-dentate, maxillary palpi 4-jointed. Parapsidal furrows short, obtusely joined just before apex scutum. Scutellum with a cross-suture at base of distal ⅓. Propodeum with a median carina and short neck, petiole quadrate. Segment 2 half of surface, twice 3, which is large; ovipositor not extruded. Wings abbreviated, reaching base of abdomen, clavate, truncate at apex, brown, naked except for

4–5 very elongate, gross setae from the venation, which extends nearly to apex and terminates in a sessile, globular stigmal vein.

PSEUDIPARELLA EMERSONI sp. nov.

Reddish-brown, the coxae and scape paler, cheeks below eyes dusky; flagellum except pedicel beneath, parapsides, dorsum (yellowish towards base) and upper sides abdomen, black. Scutellum with four bristles, the caudal pair farther apart and on the cross-suture; scutum with scattered short setae and a pair of short bristles caudad in disc. Pedicel subelongate, funicles subquadrate, 7 wider, A pair of stout bristles from upper occiput, these wide apart.

Tasm.: Wilmot (A. M. Lea and H. J. Carter). One female.

PACHYNEURON Walker.

PACHYNEURON KINGSLEYI Girault.

A female from Tasmania.

ISOPLATOIDES Girault.

ISOPLATOIDES QUADRIPUSTULATUS sp. nov.

As *I. tripustulatus,* but parapsidal furrows complete, first two spots on wing united, and there is a fourth spot farther distad than 3, nearly midway between apex of stigmal and apex of wing. Antennae red, tegulae yellow, trochanters, tarsi, knees, tibial tips white, also all of tibia 1 above. Ring-joint 3 equal the others; funicle 1 twice longer than wide, distinctly exceeding pedicel. Clypeus somewhat produced, concaved widely across apex. Propodeum as in named species. Jaws 4-dentate, 4 obtuse at apex and shorter.

The complete parapsidal furrows in *I. tripustulatus* are more apparent than real (so often the case in these small metallic Pteromalinae and Miscogasterinae), so that the species differ, so far as known (all jaws have not been seen), only in colour and marks on wing. The parapsidal furrows in this genus are at first strongly oblique, but after middle they suddenly turn almost to the perpendicular.

N.S. Wales: Barellan (A. M. Lea). One female.

SUB-FAMILY MISCOGASTERINAE.

SYSTASIS Walker.

SYSTASIS KEATSI sp. nov.

Wing with a midlongitudinal fuscous stripe from opposite base marginal vein. Head umbilicately punctate. Spaces between jaw teeth 2–3 serrate. Knees and tibiae red, antennae black, knees 1–2 widely red.

Bronze. Scutum, lateral parapsides umbilicately punctate, scutellum with a longitudinal line of these punctures on each side of meson (not close to median line); clypeus with a fovea on each basal corner; a line of slender ciliae under marginal vein. Propodeum strongly 3-carinate. Tegulae red. Funicles quadrate. Lateral ocelli closer to eye than to median. Scrobes deep, very short.

S. Aust.: Mount Lofty (A. M. Lea). One female by sweeping.

EROTOLEPSIELLA Girault.

EROTOLEPSIELLA NEMORUM sp. nov.

Scutellum with only the apical bristles, these gross, scutum pilose.

Metallic; knees 1–2, tibia 1, also 2 except out from base above, tarsi, red-yellow; tibia 3 at base ivory. Second stripe forewing large, convex on each margin (from most of postmarginal vein); first widens caudad, and is from a loose hair patch at base of bend of submarginal. Larger hind tibial spur shorter than tarsus 1 (latter equal 2–3). Lateral ocelli nearly twice closer to eye than to median, vertex pin-punctate. Abdomen coarsely scaly, segments 4–5 longest. Scutellum with a distinct cross-suture before apex, distad of this finely long-striate, this part equal the glabrous postscutellum. Apex of segments and propodeum (nearly) smooth, latter tricarinate, but lateral carina obscure, a distinct spiracular sulcus and a collar-like neck. Longish setae on distal segment; (antennae missing). Parapsidal furrows complete.

Tasmania. One female.

SUB-FAMILY EULOPHINAE.

CLOSTEROMYIIA Girault.

CLOSTEROMYIIA SPECIOSA sp. nov.

As the genotype, but stripe at base of marginal vein oblique; the second stripe is from a little distad of middle of marginal, and forms a crooked Y with the one from the stigmal and postmarginal veins; the tail of this Y is the thickest part. No distal arm from this, and no hyaline dots in the middle stripe; a small streak of brown in middle of wing between first stripe and the Y. A line of slender discal ciliae along marginal.

Legs yellow except coxae, femora 2–3, dorsal edge femur 1 at base. Otherwise the same. Scutellum with four bristles.

The head, antennae, and hind wings were missing from this specimen.

Tasm.: Strahan (A. M. Lea and H. J. Carter). An apparent female.

Although the sex of this specimen is not known with certainty, and the antennae are missing, it has all the other characters of the genus, and I must confess that the striking and beautiful marking of the forewing has been my guide in assigning it its position. The genotype also has a heavily marked and beautiful wing, characteristic of some genera, e.g., *Closteroceras*.

ENTEDONELLA Girault.

ENTEDONELLA AEREISCAPUS sp. nov.

Aeneus, venation black, wings clear; knees, tibial tips, sides of tibia 1, joint 1 of first two pairs of tarsi, paler. Funicle 1 half longer than wide, subequal pedicel; club acute, no terminal spicule. Densely scaly-punctate. Lateral ocellus somewhat closer to eye than to median. Parapsidal furrows ending in a shallow depression; two bristles on apical scutellum. Spiracle round, on a plain surface, an impression mesad of it; caudal margin propodeum sulcated. Petiole very short, abdomen equal rest of body. Postmarginal exceeding stigmal. As genotype. Very close to next. The genera here have since been carefully revised and this difficult group better ordered.

S. Aust.: Mount Lofty Range (N. B. Tindale). One female.

PELOROTELOPSELLA Girault.

PELOROTELOPSELLA AUSTRALIENSIS Girault.

As description of genotype, but scape metallic except at base, tibia white at tip (not distal $\frac{1}{3}$), tibia 1 entirely white narrowly dorsad. The groove along each side of median carina is deep and with acute lateral margins. The lateral sulcus also has acute lateral margin. Venation dark.

Abdomen sessile, longer than wide. Parapsidal furrows "interrupted" behind middle. Densely scaly punctate. Bristles scutellum gross.

S. Aust.: Melrose, Oct. (A. M. Lea). One female.

SUB-FAMILY AGAONITINAE.

PLEISTODONTES Saunders.

PLEISTODONTES NIGRICAPUT sp. nov.

Differs from *P. imperialis* in having the underside of femora, the scape, the tibiae, and tarsi yellow, wings hyaline; and from *P. froggatti* in having the scape short and convexly dilated, and in other ways; from *P. nigris* in the colour of the femora, and perhaps in the male.

Male: Head black, rest of body white; the hind margin of head convex and entire, club notably short, almost quadrate and truncate at apex.

Female: Head nearly twice longer than wide, jaws at least 4-dentate, funicle 2 cup-shaped, a bit longer than wide and distinctly smaller than 3, latter half longer than wide, equal 4, pedicel globular, small. The scape bears a distinct tubercle just before middle, but this is on the shaft, and is covered by the regular convex expansion.

S. Aust.: Adelaide: Many specimens from *Ficus rubiginosus*. Also six females from same host, N.S. Wales, Sydney (A. J. Coates).

PLEISTODONTES FROGGATTI Mayr.

A female of this species taken at light, Cairns, Queensl. (A. M. Lea).

It agrees with Grandi's figures, but funicle 2 was distinctly shorter in proportion to 3, only half longer than wide, and only about ½ of 3. Ovipositor ⅔ abdomen.

BLASTOPHAGA Gravenhorst.

BLASTOPHAGA NIVEIPES sp. nov.

As *B. insularis*, but black, scape (brown-yellow), funicle 1, and legs dusky snow-white, thorax beneath and a quadrate area centrally on face just above antennae, pallid; club solid, scape with the tubercle beneath, uniformly, convexly dilated. Pedicel thickly beset with stout spines, exceeding all funicles, of which 1 is wider than long, 2 cup-shaped and smaller than the rest, which are a bit longer than wide. The sheath is as in *B. insularis*, but terminates in a stout, colourless spine, and attains apex of 3. The head narrows a bit cephalad, and is somewhat longer than wide. Postmarginal shorter than marginal, exceeding stigmal.

N. Terr.: Roper River (N. B. Tindale). From *Ficus glomeratus*.

A comparison of the type of *B. insularis* shows these differences: The pedicel is not thickly beset, as above, but its spines are longer and less dense, the head is smaller, with less obvious setae, the club segmented distinctly, the legs are dark, scutellum with a cross-row of only a few (4) dots, many in other; tibia 1 is not heavily armed at apex, the postmarginal vein is faint and shorter, and there is no distinct patch of ciliae on caudal margin near base as in the other. Thus the two species differ in a number of structural details.

BLASTOPHAGA SEMIAURICEPS sp. nov.

Differs from *B. insularis* and *B. nigriscapus* in having the lower part of head and face up to middle yellow; from the former: ovipositor only ½ abdomen, funicle 1 shorter than 2, which is shorter than pedicel, entirely black except parts mentioned, tibiae, tarsi, much of femur 1, red-brown; no tubercle on ventral scape, club joints distinct, subquadrate. Scape with a rather large bulge beneath centrally.

From *B. ghigii:* Tibia 3 above without long hairs, 1 of tarsus 3, 2½ times longer than wide and exceeding 2 plus 3 (in other only ⅓ longer than wide and equal 2 and 3 united, the latter wider than long); the antennal fovea is quite different, being a deep circular excision, and there is no median suture from it (males).

S. Aust.: Adelaide, Dec., 1913 (H. H. D. Griffith). Many specimens of both sexes. Cotypes in Queensland Museum.

The sheath ends in an *acute* pale spine, and does not attain to apex of 3.

A NEW BUTTERFLY OF THE GENUS PAPILIO FROM ARNHEM LAND

BY NORMAN B. TINDALE, ASSISTANT ENTOMOLOGIST, SOUTH AUSTRALIAN MUSEUM

Summary

Probably few large butterflies remain to be taken on the mainland of Australia, therefore the discovery of a well-defined race of Papilio leosthenes in the Northern Territory was unexpected.

A NEW BUTTERFLY OF THE GENUS PAPILIO FROM ARNHEM LAND.

By NORMAN B. TINDALE, Assistant Entomologist, South Australian Museum.

Fig. 106.

Probably few large new butterflies remain to be taken on the mainland of Australia, therefore the discovery of a well-defined race of *Papilio leosthenes* in the Northern Territory was unexpected.

PAPILIO LEOSTHENES GEIMBIA subsp. nov.

Fig. 106, A.

♂ Forewings above white, faintly greenish-yellow at base, with four oblique broad black bands; the first two in basal third reaching from costa to dorsum; the third subtriangular, with apex truncated, reaching from costa to vein 2; the fourth similar in shape, reaching from costa opposite apex of cell to base of vein 5; apical third of wing broadly black, a subterminal dusky white band from costa, becoming obsolete near vein 2; traces of an inner band. Hindwings white; apical third black; a series of obsolete discal spots whitish, at tornus bluish-grey; a black band parallel to dorsum from costa near base to the tornal spot; another from one-third costa to vein 2 bordered outwardly beyond cell by two orange spots; a large tornal spot and a smaller one in area 2 orange, margined outwardly with black, inwardly with white; a small whitish suffusion in apical fourth of area 2; tail black, tipped whitish.

Forewings beneath with markings as above, greyish-black instead of black. Hindwing as above; with two additional orange spots outwardly margined with black in areas 6 and 7. Expanse, 74 mm.

♀ Markings as in male. Expanse, 72–86 mm.

Hab. Northern Territory: Alligator River, on the sandstone tableland (D. D. M. Campbell). One male and two females were examined. The type, a male, I. 14867, is in the South Australian Museum; the allotype female (fig. 106, A), 86 mm. in expanse, is in the Auckland Museum. There is a fourth example in the Auckland collection which has not been examined. We are indebted to Mr. J. A. Porter, of Darwin, for our type example, and to Mr. Campbell for the loan of one of the specimens he presented to the Auckland Museum. The name chosen is derived from that of a tribe of natives (Geimbia) inhabiting the Alligator River tableland.

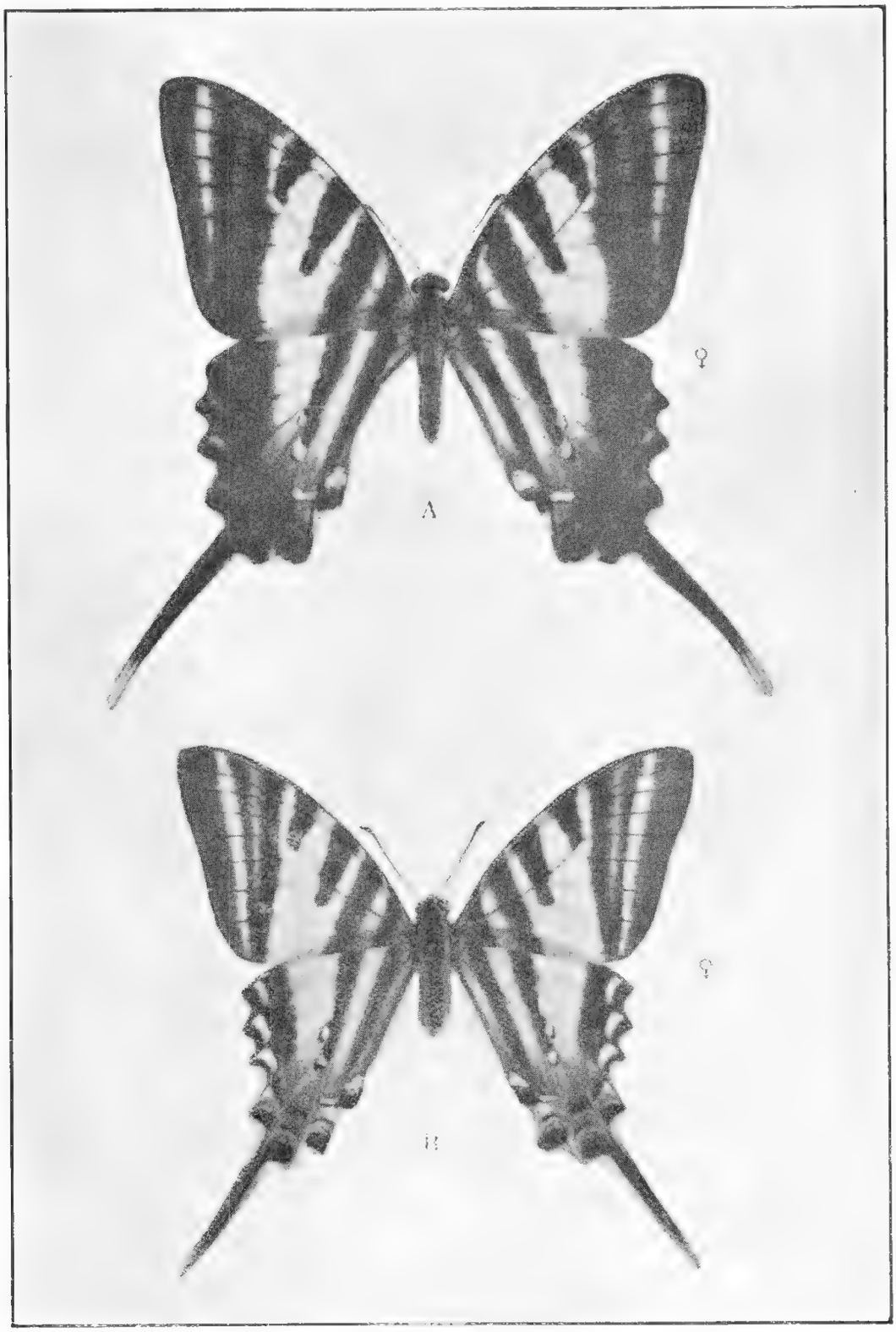

Fig. 106. A, *Papilio leosthenes geimbia* subsp. nov. allotype female; B, *P. leosthenes leosthenes* Doubleday, female, Brisbane.

P. l. geimbia differs from typical *P. l. leosthenes* in its larger size, relatively broader hindwings, and longer tail. The black areas on both wings are more extensive, and the subterminal white markings are obscured. The four dusky orange spots on the hindwing are strongly developed, and the tail is without the posterior white border.

PAPILIO LEOSTHENES LEOSTHENES Doubleday.

Fig. 106, B.

Doubleday, Ann. Nat. Hist, xviii, 1846, p. 372; Gray, Cat. Lep. Ins. British Museum, i, 1852, p. 30, pl. iii, f. 1; Waterhouse and Lyell, Butt. of Aust., 1914, p. 165, pl. xxix, f. 553.

No more definite locality than that of "Australia" was given in the original description, and no subsequent author has fixed a type locality. As southern Queensland examples agree perfectly with the description and figures, I nominate Brisbane as the type locality, and have figured a female specimen from that locality, taken in November, for comparison with the new race. Forty-four examples have been examined, including two in the collection of Dr. G. A. Waterhouse, from Cape York.

Hab. New South Wales: Sydney, Dorrigo, Richmond River; Queensland: Brisbane, Esk, Mackay, Cape York.

ADDENDA.

Several alterations and corrections appear to be necessary in one of my previous papers (1).

Eulepis pyrrhus sempronius Fab., p. 342. I wrongly followed Kirby's correction, which was made in error; the name *E. p. canomaculatus* Goeze, which is a synonym of typical *E. p. pyrrhus* Linn., from Amboina, cannot be applied to the Australian race.

Delia ennia theodora nom. nov. in place of *D. e. dorothea* (p. 349), which name has previously been used by Mitis.

By the omission of portions of two lines in my list of the butterflies of Groote Eylandt (p. 353, line 8), *Lycaenesthes emolus affinis* W. and L. appears in a wrong genus, and *Catochrysops platissa* Herrich-Schaeffer is omitted. *Yphthima arctous* Fab., taken on Groote Eylandt in February and April, was also omitted from the list.

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(1) Tindale, Trans. Roy. Soc. South Australia, xlvii, 1923, p. 342-354.

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OBITUARY AND BIBLIOGRAPHY OF MR. EDGAR R. WAITE

BY HERBERT M. HALE, SOUTH AUSTRALIAN MUSEUM

Summary

Edgar Ravenswood Waite was born in May, 1866, in Leeds, both his parents being Yorkshire people. His father was for forty years foreign correspondent for a Leeds bank, and entered his son Edgar Waite, as a youth, in the Borough Accountant's Office at Leeds, where he acquired business habits which proved useful later. Early in life Mr. Waite envinced a keen interest in natural science, and received a grounding in biology by taking a course at the Victoria University, now the University of Manchester. In 1888, at the age of 22, he was given his first scientific appointment, that of sub-curator of the Leeds Museum, and three years later was made curator of that institution. At this early period he aws mainly interested in ornithology, but also familiarized himself with Museum work, visiting the principal museums of Britain, and also many of the continental ones, including those of Berlin, Dresden, Prague, Brussels, Antwerp, Rotterdam, Leyden, and Amsterdam. While curator at Leeds he was co-editor of the "Naturalist" (London), Joint Honorary Secretary of the Yorkshire Naturalists' Union, and Honorary Librarian of the Conchological Society of Great Britain and Ireland.

MR. EDGAR RAVENSWOOD WAITE, F.L.S., C.M.Z.S.

Director of the Museum - - - 1914-1928

Editor of Records of S.A. Museum - 1918-1928

Born May 5, 1866. Died Jan. 19, 1928.

OBITUARY AND BIBLIOGRAPHY
OF MR. EDGAR R. WAITE.

By HERBERT M. HALE, South Australian Museum.

Edgar Ravenswood Waite was born in May, 1866, in Leeds, both his parents being Yorkshire people. His father was for forty years foreign correspondent for a Leeds bank, and entered his son Edgar Waite, as a youth, in the Borough Accountant's Office at Leeds, where he acquired business habits which proved useful later. Early in life Mr. Waite evinced a keen interest in natural science, and received a grounding in biology by taking a course at the Victoria University, now the University of Manchester. In 1888, at the age of 22, he was given his first scientific appointment, that of sub-curator of the Leeds Museum, and three years later was made curator of that institution. At this early period he was mainly interested in ornithology, but also familiarized himself with Museum work, visiting the principal museums of Britain, and also many of the continental ones, including those of Berlin, Dresden, Prague, Brussels, Antwerp, Rotterdam, Leyden, and Amsterdam. While curator at Leeds he was co-editor of the "Naturalist" (London), Joint Honorary Secretary of the Yorkshire Naturalists' Union, and Honorary Librarian of the Conchological Society of Great Britain and Ireland.

In 1892 the Trustees of the Australian Museum, Sydney, required an Assistant in Zoology to take charge of Mammals, Reptiles, Fishes, and General Osteology. Mr. Waite was selected for this post, and on coming to Australia commenced his career as a research worker; thereafter his life was occupied in the study of the Australasian fauna and in the work of Australasian Museums. He published his first taxonomic paper in 1893, when he described some Australian blind-snakes and, in the succeeding years during which he worked in the Australian Museum, he studied mammals, reptiles, and amphibians, and paid particular attention to fishes, a group in which he was becoming increasingly interested. Important collections from other Australian Museums were entrusted to him for investigation and identification, the Muridae obtained by the Horn Expedition to Central Australia, and the fishes trawled by the Western Australian Government. In February and March, 1898, he acted as naturalist to a trawling expedition conducted in H.M.C.S. "Thetis," when marine material was collected at 59 stations off the coast of New South Wales, and wrote the scientific report thereon.

In 1906 he succeeded the late Capt. Hutton as Curator of the Canterbury Museum, Christchurch, New Zealand; for eight years he devoted the whole of

his energies to the work of that institution, effecting many additions and improvements during his tenure of office. He recovered, at Okarito, one of the largest recent mammal skeletons in the world, that of a stranded Blue-whale 87 feet in length, and supervised the mounting of this in a specially constructed building. He introduced the method of exhibiting fishes by means of coloured casts, a procedure which proved far superior to the older stuffed skins, which almost invariably became shrunk and distorted. Later he extended the process to Cetaceans also, the largest aquatic mammal cast being a strap-toothed Whale, 18 feet in length. He found time to continue his assiduous researches, extensively studying the fishes of New Zealand, and becoming recognized as one of the leading Australasian ichthyologists. A year after his arrival in New Zealand he was instrumental in inaugurating the Records of the Canterbury Museum, a publication for the purpose of recording observations and investigations of the staff of the Museum. He edited the four parts of volume i, and the first part of volume ii of that periodical, and himself wrote much of the matter comprising each part.

While in New Zealand Mr. Waite had opportunities of extending his field experience very considerably, and was connected, as zoologist, with the following important expeditions. In 1907 he accompanied His Excellency the Governor, the late Lord Plunket, to the Southern Islands of New Zealand; was in charge of the investigation department of a Government Trawling Cruise; and studied the vertebrates during the Canterbury Philosophical Institutes' Expedition to the subantarctic islands of New Zealand. In 1908 he led a Museum expedition among the northern Maories; a year later went to the West Coast Sounds to study the vertebrates of that region; and in 1910 was a member of an investigation committee which visited the New Zealand lakes. He was on board the "Aurora" during the first subantarctic cruise of Sir Douglas Mawson's Australasian Antarctic Expedition in 1912, and next year accompanied the G.S. "Tutanekai" when she proceeded to Macquarie Island for the purpose of reprovisioning the scientific party stationed there by the expedition. After almost all of his excursions Mr. Waite published the results of his investigations and collections, and as these papers are referred to in his bibliography no further comment is needed; in fact his published contributions to science convey to posterity much more lasting records of his capabilities than these brief biographical notes.

From the beginning of 1914 until the time of his death he occupied the position of Director of the South Australian Museum. When he took charge here the installation of exhibits in the New Wing was just commencing; he occupied himself enthusiastically with this work and, as a result of his twenty-six years' experience of museums, was able to introduce many innovations. He designed the grouping of many of the cases in the mammal and bird galleries, and

also re-arranged some of the material in the older portion of the Museum. The new wing was officially opened in December, 1915, but the cases and exhibits were continually augmented, under his supervision, until the close of last year.

Soon after his arrival in South Australia Mr. Waite commenced work on the Antarctic fishes collected by the Australasian Antarctic Expedition, the first of the investigations in which the writer of this notice, as his personal assistant at the time, was privileged to participate. On account of his associations with this expedition Mr. Waite was greatly interested in the fauna of the cold southern seas, and in 1921 arranged an Antarctic case, which stands at the western end of the old museum. He designed and painted the greater part of the background of this case; the scene is set near Cape Royds, and shows Mt. Erebus in eruption largely obscured by a snowstorm. Antarctic mammals and birds, and some of the gear used by Sir Douglas Mawson and his companions, are exhibited. Two dogs are included in the group; one of these was used by Sir Douglas Mawson, and the other, a Siberian dog named 'Serai.'' belonged to the expedition organized by Capt. Robert F. Scott. After this ill-fated expedition ''Serai'' was presented to Mr. Waite, and for some years the dog was the most treasured of the numerous pets he kept at his home. ''Serai'' eventually died of old age, and was mounted in the Antarctic case.

When Mr. Waite came to South Australia the Museum already possessed a series of casts of animals, but he at once arranged for the preparation of further reproductions of fishes, which were painted by the late Mr. Gustave Barnes. With the co-operation of fishermen and others, he greatly increased the number of exhibited fish casts, the most noteworthy example being that of a Basking Shark 25 feet in length which, it is said, had the distinction of being the largest cast of a fish hitherto attempted.

When a large Blue Whale, equal in size to the aforementioned Okarito whale, was stranded at Corvisart Bay in 1918, Mr. Waite was insistent that arrangements should be made for securing its skeleton. He made visits to the locality, and later described the gigantic mammal in detail. The macerated skeleton is now stored, Mr. Waite not living to see it mounted for exhibition. Other smaller whales cast up on our shores were examined by him, and he recovered the skeleton of a young Strap-toothed Whale, now on exhibition in the Museum.

Mr. Waite was ever desirous to advance the status of institutions with which he was associated, and with this end in view he earnestly recommended that the South Australian Museum should publish its own journal; the first part of the ''Records of the South Australian Museum'' appeared in 1918, and each succeeding year a number was produced under his editorship.

As shown in the Bibliography, Mr. Waite published forty papers during his fourteen years of activity in our State: in them he deals with mammals, birds, fishes, reptiles, amphibians, and some ethnological objects. His most useful ichthyological contribution was a catalogue of the South Australian fishes, which he enlarged later to form one of the British Science Guild Handbooks. At the time of his death he had almost completed a second handbook dealing with our reptiles and amphibians, and this will be published posthumously.

Mr. Waite made numerous official excursions in South Australia, and took charge of three important ventures. Shortly after his appointment he made a cruise to the Great Australian Bight in the Government Trawler "Simplon"; in 1916 in company with Capt. S. A. White he led a Museum expedition to Central Australia; and in 1918 went to New Guinea, New Britain, and New Ireland in search of material for the Museum. On two occasions he accompanied Professor Wood Jones on trips organized for the biological survey of the Nuyts Archipelago and the Investigator Group.

For years Mr. Waite was looking forward with happy anticipation to a visit to America and to Europe, where he hoped to renew old acquaintances and to familiarize himself with modern requirements of museums. He spent the latter half of 1926 on this tour, and made many observations, particularly in the American Museum of Natural History, where he worked for three weeks planning the arrangement of two cases which contain groups illustrating phases of Australian zoology. On his return he confessed that the trip was a disappointment in many ways; he was ill during the voyage to England, and after the following seven months of strenuous travelling and research, returned to Adelaide tired and rather dispirited. He then stated that much of the glamour of early associations at home had vanished after more than thirty years' absence, and that he considered his surveys in the United States had been too brief owing to the time occupied in travelling.

At the age of fifty Mr. Waite contracted malaria in New Guinea, and in subsequent years numerous attacks of fever, with its concomitant disorders, did much to undermine his health. The photograph here reproduced was taken in Berlin only eighteen months before his death, and is a faithful representation of his appearance during the last few years. Those who knew him earlier cannot fail to note the changes effected by suffering, which he bore uncomplainingly with fortitude and courage. In January of this year he was to have attended conferences in Tasmania in regard to Marine Biological stations and Museum matters: he developed typhoid fever early in the month and shortly became seriously ill, but, confident that he was suffering from an unusually severe bout of malaria, he struggled to Tasmania, fighting against great disabilities, and hoping each day

that the attack would abate. He became rapidly worse, however, and on January 19th passed away in Hobart, where 700 colleagues were gathered at the Science Congress.

For the greater part of his life Mr. Waite was a Fellow of the Linnean Society of London, to which he was elected in 1890, and was at one time a councillor of the Linnean Society of New South Wales. In South Australia he took great interest in the Royal Society, was a council member for five years, and this year was Senior Vice-President. As already indicated, from an early period in his career societies which in any way encourage the study of natural history claimed his attention. In our State he attended the meetings of the Field Naturalists, the Anglers' Association, and various clubs, and each year delivered addresses at some of these gatherings. Ten years ago he was one of a small meeting of amateur aquarists who founded the South Australian Aquarium Society (which now has a membership of forty) and was president for six years of the existence of the Society. He was a member of the Fauna and Flora Board, a councillor of the Zoological Society (South Australia), and, more recently, was appointed a corresponding member of the Zoological Society of London. He occupied a seat on the handbooks committee of the local branch of the British Science Guild, and was editor of the Handbooks, now in course of publication, dealing with the fauna and flora of South Australia. He took deep interest in the Flinders Chase Reserve on Kangaroo Island, and, as a member of the Fauna and Flora Board, made several trips to the Island for the inspection and stocking of the Reserve and for the collecting of specimens in order that a complete knowledge of the fauna thereon might be gleaned. He was a member of the Anthropological Society of South Australia, which was founded in 1926.

From his youth onwards Mr. Waite undertook considerable editorial work in connection with scientific and natural history publications. In this direction he was punctilious and keenly critical, even of his own work, demanded from those with whom he was associated concisely worded statements incapable of misconstruction, and discouraged the publication of theories not built upon a firm foundation of fact. Unselfishly, he was always ready to give time and thought to the perusal of manuscript submitted to him for criticism, and much of his editorial work was executed anonymously.

Mr. Waite spent forty years in his chosen field, Museum management, and was in every respect an ideal museum officer. He derived great pleasure from the preparation of public exhibits and the display of groups, and was justly proud of the cases arranged by him. He encouraged research on the reserve collections, not the least important function of a museum, and was fastidiously careful in replying to enquiries regarding natural science, often spending much

time in order to be able to furnish complete information or to make identifications. His activities in the various Societies mentioned did much to increase the collections of the Institution.

In his private life Mr. Waite was rarely idle, as he had several hobbies which occupied much of his leisure. He was an ardent motor cyclist, his experience dating back to the days when a non-stop run of ten miles was an achievement. While at the Australian museum he became interested in aquarium keeping, and for more than thirty-five years maintained private aquaria and ponds. These were almost all made by himself in his own workshop. A year after his arrival in New Zealand he exhibited aquaria in the New Zealand exhibition, and was awarded a gold medal for a marine installation. In 1922 some of us attempted to stimulate public interest in a proposal to erect an Aquarium for the State, and in this project Mr. Waite was a prominent worker. He collected postage stamps, but his interest in philately was, in the main, limited to those stamps on which animals are depicted, or on which animals are the motif of the design. He had artistic talents and made many sketches in the field, while his ability to execute pictures in oils, wash, or line, was a great advantage to him in his researches. He was also an experienced photographer. He was very fond of music, and derived much enjoyment from his flute. His interest in this instrument dated from his boyhood when he and his brother, in ransacking some boxes at their home, discovered two old flutes. The father found the boys attempting to master these and forthwith arranged for them to receive professional instruction. In South Australia he and the late Mr. Commissioner Mitchell, who was also a flautist, spent many evenings together rendering the classical selections which appealed to them both. Mr. Waite was an original member of the South Australian Flute Club, which was inaugurated in 1926, and took part in two of the concerts arranged by the Club.

Mr. Waite was a member of most of the camping parties arranged by naturalists' societies, and on these informal gatherings could be as happily irresponsible as the youngest participant. He was of a retiring disposition, heartily disliked social functions, and did not readily make close acquaintances; those who were privileged as such, however, know how lasting were the friendships he made.

He was a member of the Yorkshire Society of South Australia, and took pride in his ability to speak and recite in the Yorkshire dialect. Like all good Yorkshiremen he was somewhat conservative, but when convinced of the wisdom of a particular course of action he followed it with patience and enthusiasm, and did all in his power to forward any proposal of which he approved.

Mr. Waite was a valued colleague in the laboratory and a happy companion in the field. One cannot quote a more fitting tribute to his personality than that

furnished by Professor F. Wood Jones, F.R.S., now of Honolulu, but formerly of Adelaide, when expressing deep sorrow at the loss of an esteemed friend: "Under all the varied conditions in which I came into contact with Waite I found about him that charm which, inherent in a gentle nature, was in him so much enhanced by his high ideals and love of real scientific work. In spite of the fact that I am far away from Adelaide, indeed perhaps because of that fact, I realize how very great a loss Adelaide has sustained. Waite was a museum director and an extraordinarily good one. He was an ichthyologist and herpetologist of international reputation, but he was far more than that. He was a gentle soul who lived a brave life, and did that best thing that anyone can do, he gave to life far more than he asked from it."

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THE SEA-LILIES, SEA-STARS, BRITTLE STARS AND SEA-URCHINS OF THE SOUTH AUSTRALIAN MUSEUM

BY HUBERT LYMAN CLARK, MUSEUM OF COMPARATIVE ZOOLOGY, CAMBRIDGE, USA

Summary

The collections dealt with in this report are the property of the South Australian Museum, Adelaide, and were sent to me for study by Mr. Edgar R. Waite, the late Director of that institution, to whom I extend my heartiest thanks. My thanks are also due, for opinions and helpful suggestions, to my colleagues, Mr. A. H. Clark (of the United States National Museum), Dr. W. K. Fisher (of Leland Stanford Junior University), and Dr. Th. Mortensen (of Copenhagen). All holotypes are in the Museum collection.

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By HUBERT LYMAN CLARK, Museum of Comparative Zoology, Cambridge, U.S.A.

Text figs. 108-142.

The collections dealt with in this report are the property of the South Australian Museum, Adelaide, and were sent to me for study by Mr. Edgar R. Waite, the late Director of that institution, to whom I extend my heartiest thanks. My thanks are also due, for opinions and helpful suggestions, to my colleagues, Mr. A. H. Clark (of the United States National Museum), Dr. W. K. Fisher (of Leland Stanford Junior University), and Dr. Th. Mortensen (of Copenhagen). All holotypes are in the Museum collection.

This is the sixth considerable collection from Australia which has been entrusted to me for study, apart from my own collection from Torres Strait, and it is in many particulars the most notable. As the holothurians of the South Australian Museum were studied and reported on by Joshua and Creed (1), no holothurians were sent to me, but in spite of that, far more specimens are in this collection than in all the other five combined. The number of forms represented is much larger than even in the notable "Endeavour" collection, and although the new species are not quite so numerous as in that great series, they are equally interesting as a contribution to our knowledge of the echinoderm fauna of Australia. Moreover, while the "Endeavour" collection contained one form so extraordinary as to require a new genus for its reception, the present collection contains two such, one a brittle-star, the other a sea-urchin; fortunately both are represented by a large series of specimens.

The South Australian Museum collection contains 2,937 specimens, representing 140 species and five varieties. Of these, forty-one representatives of twenty species are non-Australian, and, as most are common European or American forms, it seemed best not to include them in their normal systematic position, but to devote the report wholly to the Australian fauna. Nevertheless, in the introductory paragraph to each class I have listed these species in order to make the report on the collection complete.

(1) *Trans. Roy. Soc. S. Aust.*, xxxix, 1915, pp. 16-24, pls. ii-iv.

There are then 2,896 specimens, representing 120 species and five varieties of Australian echinoderms. It is unfortunate that a number of specimens have no labels showing the locality whence they came, and a larger number have labels with the somewhat indefinite information, "Spencer and St. Vincent Gulfs." As a result there are cases where the origin of the specimen is very uncertain, but in many of the most important species the locality labels are sufficiently detailed to meet our requirements.

The bulk of the collection comprises material collected by Sir Joseph Verco in the course of his extensive dredging and searching for molluscs. As a result of his indefatigable efforts noteworthy series of many rare and remarkable echinoderms are preserved in the Museum. At least seventy-five of the 125 species and varieties in the collection were taken by him, and material of twenty-one new forms, including the two aforementioned new genera, was accumulated by him.

Nine of the 125 forms are crinoids, thirty-nine are asteroids, thirty-nine are ophiurans, and thirty-eight are echini. It is noteworthy that so large a proportion are echini, for there are at least twice as many ophiurans now known as there are echini, and probably at least three times as many sea-stars. No fewer than thirty-one new species and two new varieties are here described. In addition a sea-star and a brittle-star also probably represent undescribed species; there is only a single specimen of each, in a condition which does not warrant detailed description. At least six species are here recorded from Australia for the first time, so that practically one-third of the forms in the collection are additions to the list of Australian echinoderms.

Of the 125 forms, thirty are from the coasts of northern, north-western, or north-eastern Australia, and hence belong to a tropical fauna quite unlike that of the southern coasts of the continent. No fewer than sixty-four of the remaining ninety-five forms are confined to the coasts of Australia south of latitude 33°, and as these make up the characteristic fauna of South Australia, it seems worth while to list them here:

CRINOIDS.

Comatula brachiolata
Comanthus trichoptera
Ptilometra macronema
Compsometra incommoda
Euantedon paucicirra

ASTEROIDS.

Astropecten pectinatus
" *preissii*
" *syntomus*
Nectria multispina
Nectria ocellata
Pentagonaster dübeni
Tosia australis
" " var. *astrologorum*

Anthaster valvulatus
Austrofromia australis
Petricia vernicina
Asterina atyphoida
Patiriella calcar
„ *gunnii*
Nepanthia grandis
Echinaster glomeratus
„ „ var. *extremus*
Plectaster decanus
Allostichaster regularis
Smilasterias irregularis
Uniophora granifera
„ *gymnota*
„ *multispina*
„ *obesa*
„ *sinusoida*
„ *uniserialis*

OPHIURANS.

Ophiomyxa australis
Astroconus australis
Ophiacantha brachygnatha
Ophiocomina australis
Amphiura trisacantha
Ophiactis tricolor
Ophiothrix albostriata
„ *caespitosa*
„ *hymenacantha*
„ *lineocaerulea*
Ophiocoma canaliculata
„ „ var. *pulchra*
Ophiurodon opacum
Pectinura assimilis
Ophiarachnella ramsayi
Amphiophiura colleta
Ophiomusium anisacanthum
„ *aporum*
„ *simplex* var. *australe*
Ophiocrossota heteracantha

ECHINI.

Genocidaris incerta
Temnopleurus australis
Microcyphus annulatus
„ *compsus*
„ *pulchellus*
„ *zigzag*
Amblypneustes ovum var. *pachistus*
Holopneustes inflatus
Pachycentrotus australiae
Ammotrophus cyclius
„ *platyterus*
Echinocyamus platytatus
Fibularia plateia

The following fifteen species are also characteristic of the southern Australian region, but occur north of lat. 33° at least on the West Coast, where some range as far north as Shark Bay, between 24° and 28°:

Astropecten vappa
Luidia australiae
Echinaster arcystatus
Astroboa ernae
Amphiodia mesopoma
Ophiothrix spongicola
Goniocidaris geranioides var. *tubaria*
Amblypneustes formosus
„ *ovum*
„ „ var. *grandis*
„ *pallidus*
Holopneustes porosissimus
Heliocidaris erythrogramma
Peronella peronii
Protenaster australis

No doubt some (perhaps many) of the species on the first list will be found to belong to the second, when the fauna of Western Australia is better known, but the two lists together give an excellent indication of the echinoderm fauna of the coast of South Australia. Other species are known from the last-named, but we are not yet in position to attempt a complete summary of the echinoderm fauna of that interesting region.

We are still very ignorant regarding the fauna of the coast of the Northern Territory, the number of species actually known from Port Essington and Port Darwin being insignificant. The material in the present collection is of little assistance, as it rarely has definite locality labels, and in not a few cases it merely is assumed that the specimens came from the northern coast. As an interesting contrast to the lists already given of South Australian species, it may be well, however, to list the twenty-five species which are probably from that region:

Teliocrinus monarthrus
Comanthus parvicirra
Lamprometra proteela
Oligometra carpenteri
Archaster typicus
Anthenea flavescens
,, *tuberculosa*
Asterina coronata fascicularis
,, *crassispina*
Nepanthia brevis
Astrochaleis tuberculosus
Ophiothrix longipeda
,, *martensi australis*
Ophiarachnella gorgonia
,, *infernalis*
Ophiolepis superbus
Ophioplocus imbricatus
Prionocidaris bispinosa
Stomopneustes variolaris
Salmacis virgulata var. *alexandri*
Tripneustes gratilla
Parasalenia pöhlii
Echinometra mathaei
Heterocentrotus mammillatus
Peronella lesueuri

The complete difference between the faunas of the two coasts which formerly formed part of South Australia, viz., that of the Northern Territory and that of the present State, is well emphasized by the fact that although there are twenty-one genera in the above list, and forty-nine genera in the lists given of southern Australian species, there are only half a dozen genera which occur on both lists, and these are, for the most part, large and ill-defined, as, for instance, *Asterina*, *Comanthus*, *Ophiarachnella*, and *Ophiothrix*.

It is hoped that the publication of this report will serve as a stimulus to more intensive collecting of echinoderms on both the coasts referred to, and that a study of this interesting list will lead to the solution of some of its many problems connected with the marine fauna. Such study can be pursued to greater advantage by local investigators (who can collect and observe the living animals), than by one who is handling preserved material in a museum on the other side of the globe.

CRINOIDEA

There are 149 crinoids in the collection, representing nine species, of which two are new to science. Nearly half the specimens are the common *Comanthus* of the southern Australian coast, and more than half of the remainder are the common *Ptilometra* of the same region. Three of the nine species are from the coast of the Northern Territory, and hence belong to quite a distinct fauna from that of the other six. Each new species represents a genus new to the fauna of Australia.

ORDER ARTICULATA

FAMILY PENTACRINITIDAE.

TELIOCRINUS A. H. Clark.

TELIOCRINUS MONARTHRUS (2) sp. nov.

Portion of stem present, 65 mm. long, only 3·5 mm. in diameter; there are only four or five developed internodes, each with from nine to thirteen segments, which are of very unequal thickness (*i.e.*, height). Cirri over 50 mm. long, each with sixty or more segments, of which the fourth to eighth are longer than broad, all except the basal ten–twelve with a projecting tooth which is very conspicuous on the distal half of the cirrus.

Calyx 6 mm. to 8 mm. in diameter, but just above the II Br series the diameter is nearly 20 mm. Arms 27, 100 mm. to 120 mm. long, unequal in size; II Br series, 4 (3+4); III Br series, 1 only; IV Br series, present once, also 1 only; elements of division series and brachials little everted; basal brachials slightly everted and with an overlapping point on each pinnule-bearing brachial, this point being on the same side of the arm as the pinnule; on opposite side is a much less conspicuous point; these points gradually become less evident and disappear distally; first syzygy between two and three and first brachial bears a pinnule. Colour in alcohol, nearly white.

Holotype: Reg. No. E. 391.

A single specimen in alcohol, with no locality label, is all the material available of this attractive species. It is obviously nearly related to *T. liliaceus* (A.H.C.), from the eastern side of the Bay of Bengal, 419 to 463 fms., but differs from that species in having fewer internodals, much more spiny cirri, and only a single segment in the III Br series. This last feature would seem to be very characteristic, provided, of course, that further material shows it to

(2) *μόναρθρον* = *having one joint*, in reference to the composition of the III Br. series.

be reasonably constant. Probably the present specimen was taken off the coast of the Northern Territory. It would be quite surprising and very interesting if it proves to have been taken off the coast of South Australia proper.

Fig. 108. *Teliocrinus monarthrus;* side view of holotype (nat. size).

FAMILY COMASTERIDAE.

COMATULA Lamarck.

COMATULA BRACHIOLATA.

Lamarck, Anim. s. Vert., ii, 1816, p. 535.

This characteristically South Australian species is represented by eleven specimens, of which one is without a locality label, while the others are from

either Spencer or St. Vincent Gulf. The specimen without locality is dry, and has the flat centrodorsal, 5 mm. across, with a single marginal series of fourteen stout cirri; the best of these cirri have thirty segments, and the distal half is bright rose colour, which fades out basally into very pale brown; the arms were evidently over 50 mm. long in life, and are 3 mm. wide near base. The specimens from the gulfs are in alcohol, and are not very diverse in size or appearance; no one of them has the terminal portion of the cirri rose colour, but in some individuals there is a pink tinge; the largest specimen has the centrodorsal 6 mm. across and the arms fully 90 mm. long; all the specimens have ten arms, but the cirri show considerable diversity, ranging in number from thirteen to twenty-one, and in number of segments from thirty to forty-one.

COMANTHUS A. H. Clark.

COMANTHUS PARVICIRRA.

Alecto parvicirra J. Müller, Arch. f. Naturg., vii, 1841, p. 145.
Comanthus parvicirra A. H. Clark, Smithson. Misc. Coll., lii, 1908, p. 203.

There are two small, broken specimens of *Comanthus* from the "northern coast of Australia" which I am referring to this species because of the small number of arms (twenty-three to twenty-seven) and the presence of twelve to fifteen cirri, each with about fourteen segments. The arms are about 125 mm. to 140 mm. long, and are noticeably slender. The general appearance of the specimens is more like that of *C. annulatum* than it is like that of *C. parvicirra*, but if the two species are really distinct on the bases of number of arms and of cirri, then these must be regarded as representing the older species.

COMANTHUS TRICHOPTERA.

Comatula trichoptera J. Müller, Monatsb. k. preuss. Akad., 1846, p. 148.
Comanthus trichoptera A. H. Clark, Mem. Aus. Mus., iv, 1911, p. 755.

This is another of the species characteristic of southern Australia, and is represented by sixty-nine specimens from Encounter Bay, Spencer Gulf, Tumby Bay, St. Vincent Gulf, and one or more unknown localities. The largest specimen has twenty-one arms, exceeding 100 mm. each, but most of the specimens are very much smaller than this; they have twelve to twenty arms, and measure 35 mm. to 85 mm. across. There are commonly twenty to thirty cirri with fourteen to seventeen segments, but in the largest specimen there are forty-two cirri with seventeen to twenty-one segments.

FAMILY MARIAMETRIDAE.

LAMPROMETRA A. H. Clark.

LAMPROMETRA PROTECTA.

Antedon protectus Lütken, In P. H. Carpenter, Trans. Linn. Soc. Zool. (2), ii, 1879, p. 19.

Lamprometra protectus A. H. Clark, Proc. Biol. Soc. Wash., xxvi, 1913, p. 144.

There are seven specimens from the "northern coast of Australia," uniformly dark brown, lightest on the centrodorsal and nearly black at the tips of the pinnules and on the disk; when dry the colour is much lighter, almost pale fawn-colour dorsally. The smaller specimens have the arms about 60 mm. long, while the larger ones have them more than 90 mm. There are thirty-five to forty cirri, with about twenty-five segments. P_2 is very long, especially on the outer sides of the arms, with as many as thirty-five segments in some cases. There are about forty arms in the smaller specimens, but in the large ones there are forty-seven and forty-eight.

FAMILY COLOBOMETRIDAE.

OLIGOMETRA A. H. Clark.

OLIGOMETRA CARPENTERI.

Antedon carpenteri Bell, Zool. "Alert," 1884, p. 157.

Oligometra carpenteri A. H. Clark, Proc. Biol. Soc. Wash., xxi, 1908, p. 126.

There is a single specimen of this well-marked species "from cable, off Northern Territory, November, 1890." It has the calyx about 4 mm. in diameter, and the arms were 30 mm. to 40 mm. long; there are fifteen cirri with sixteen or seventeen segments. The dorsal side of the animal, including the pinnules and cirri, is very light fawn-colour, while the oral surface, including the inner side of the pinnules, is dark brown.

FAMILY THALASSOMETRIDAE.

PTILOMETRA A. H. Clark.

PTILOMETRA MACRONEMA.

Comatula macronema J. Müller, Monatsb. k. preuss. Akad., 1846, p. 179.

Ptilometra macronema A. H. Clark, Smiths. Misc. Coll., l, 1907, p. 358.

This, the commonest Australian crinoid, is represented by forty-seven specimens from Encounter Bay, St. Vincent Gulf, Spencer Gulf, off Althorpe Island

(Verco coll., 1892), and at least one unknown locality. The largest specimens have twenty-five to thirty-one arms, about 70 mm. to 80 mm. long, and more than sixty cirri, which may be 57 mm. long, and have eighty-seven segments. There are seven very small specimens, with ten arms, eighteen to twenty cirri, each nearly or quite as long as arms (20 mm. ±), with forty or more segments. Comparison of these specimens with the description and figures of *Himerometra paedophora* H. L. Clark confirm my scepticism as to that species being the young of Ptilometra, as maintained by Mr. A. H. Clark. The differences in the centrodorsal, the cirri, and the pinnules seem to me too great and too important to be ignored. But I grant that none of the Ptilometras in the present collection are small enough to enable one to reach a positive conclusion. More light is still needed on the problem.

FAMILY ANTEDONIDAE

COMPSOMETRA A. H. Clark.

COMPSOMETRA INCOMMODA.

Antedon incommoda Bell, Ann. Mag. Nat. Hist. (6), ii, 1888, p. 404.
Compsometra incommoda A. H. Clark, Mem. Aust. Mus., iv, 1911, p. 792.

There are two small, dry specimens of this little species from an unknown locality. In one the arms are about 25 mm. long; the other is yet smaller. There are twenty-eight and twenty cirri, each with about ten segments.

EUANTEDON A. H. Clark.

EUANTEDON PAUCICIRRA (3) sp. nov.

Centrodorsal low, hemispherical, about 2.5 mm. in diameter, slightly convex; cirrus sockets closely crowded, arranged roughly in two or three irregularly horizontal series. Cirri XXV, seventeen to twenty-six (usually about twenty), 10 mm. in length, more or less; three basal segments broader than long, but remainder longer than broad; sixth to tenth nearly, or quite, twice as long as the thickness at middle; in profile, the segments except basally and distally are concave on the dorsal side, much less so ventrally; distal margin of longer segments oblique, the ventral side being considerably longer than dorsal; cirri compressed distally: terminal claw, short, curved, very sharp; opposing spine, small, but sharp and conspicuous.

Radials nearly or quite concealed by centrodorsal; I Br_1 oblong, about four times as wide as long, lateral edges straight, parallel, a trifle everted; I Br_2,

(3) *Pauci*=few+*cirrus*, in reference to the relatively small number of cirri.

low, twice as broad as long, pentagonal with lateral margins, about half as long as those of I Br_1; distal angle a right angle; anterior sides little if at all concave. Arms ten, about 40 mm. long; first brachial wedge-shaped, twice as long externally as internally, just in contact internally with its fellow of the adjoining

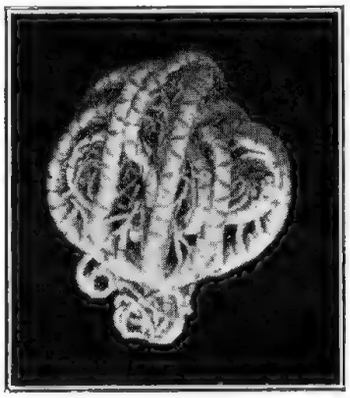

Fig. 109. *Euantedon paucicirra;* side view of holotype (x 2).

arm; second brachial, wedge-shaped, larger than first; third and fourth brachials united by syzygy, the pair about twice as long as wide; next four brachials somewhat wedge-shaped, two or three times as broad as long; succeeding brachials very obliquely wedge-shaped, about as long as broad, distally becoming elongate and little wedge-shaped. Syzygies occur between brachials three and four, nine and ten, fourteen and fifteen, and then at intervals of three muscular articulations.

P_1, 5 mm. to 7 mm. long, rather stiff, tapering, much stouter than succeeding pinnules; it has ten to twelve segments, of which the basal is twice as broad as long; the second, longer than broad; following, twice, and distally thrice, as long as broad; third and following segments with distal edge on outer side, somewhat prominent. P_2, 3·5 mm. long, with seven segments, slightly more elongate than those of P_1, with somewhat more prominent ends. P_3 slightly shorter than P_2, somewhat more slender, less stiffened, and with a gonad. Colour (dry) nearly white.

Holotype: Reg. No. E. 399.

There are two specimens of this delicate little comatulid, labelled St. Vincent Gulf. It is very closely allied to *E. tahitiensis,* but is distinguished by the fewer, smaller cirri. The genus was hitherto known only from Tahiti, the Moluccas, and perhaps the coast of China, so that its occurrence in St. Vincent Gulf is indeed notable.

ASTEROIDEA

There are 766 sea-stars in the collection, representing forty-four species and two varieties, but twenty-one specimens, representing the following seven well-known species, are non-Australian in origin:

Psilaster andromeda (M. & T.)
Pentagonaster pulchellum Gray
Hippasteria phrygiana (Parelius)
Patiriella regularis (Verrill)
Echinaster eridanella M. & T.
Crossaster papposus (Fabr.)
Asterias rubens L.

No further reference will be made to these species.

Of the remaining thirty-nine forms, ten species and one variety are described as new, while one more species, a Coronaster, is probably new, but the only specimen in the collection is too young to permit a satisfactory description. One other species, *Anthenea flavescens*, is now recorded from Australia for the first time.

Of the thirty-nine forms, thirty-three are from the southern coasts of South Australia, while six are from the waters of the Northern Territory; one of these six, an Asterina, is new.

Nearly half of the 745 specimens represent the common Australian forms of Tosia and Patiriella, while more than a hundred of the remainder are the common *Coscinasterias calamaria* and *Allostichaster polyplax*.

A new species of *Nectria* has justified giving an artificial key to the species now known of that characteristic Australian genus. Even more desirable is a key to the species of Uniophora, another very characteristic genus of the southern Australian and Tasmanian coasts, of which forty-eight specimens, representing apparently half a dozen forms, are in the present collection. Whatever may be the actual status of these forms, as determined by future research, the key will be useful in making clear the grounds upon which I have recognized them.

ORDER PHANEROZONIA

FAMILY ASTROPECTINIDAE.

ASTROPECTEN Gray.

ASTROPECTEN PECTINATUS.

Sladen, Jour. Linn. Soc. Zool, xvii, 1883, p. 251.

There is a very small *Astropecten* (R = 13 mm.) from Petrel Bay, St. Francis Island, South Australia, which I think must be referred to this species.

There is also a larger specimen (R = 40 mm.) taken by Dr. Verco in either St. Vincent or Spencer Gulf, and three little ones (R = 10 mm. to 15 mm.) from St. Vincent Gulf, which are also best treated as young *A. pectinatus*.

ASTROPECTEN PREISSII.

Müller & Troschel, Arch. f. Naturg., ix, 1843, p. 119.

This would seem to be the common *Astropecten* of southern Australia, as there are sixteen specimens in the present collection, from Spencer Gulf, St. Vincent Gulf, north coast of Kangaroo Island (April, 1888), and one or more unknown localities. More than half the specimens were collected by Dr. Verco. The smallest specimen has R = 12 mm., the largest R = 102 mm. The change in proportions with increasing size is quite notable; in a specimen with R = 15, r = 7, so that R is little more than 2 r but in the largest specimen, r = 17 mm., so that R = 6 r. Most of the specimens are nearly white, dull yellowish, or pale brown, but one lot of four specimens from an unknown locality is rich red-brown; these specimens look as though they had retained their colour in life more or less perfectly, but there are no notes to indicate what the colour in life may have been.

ASTROPECTEN SYNTOMUS (4) sp. nov.

R = 39 mm., r = 12 mm., br = 14 mm.; R = more than 3 r but less than 3 br; form very markedly stellate; rays tapering steadily to attenuate tips, but no superomarginals meet in the midradial line proximal to the terminal plate, which is large, about twice as long as wide, apparently bare except at middle of proximal end. Superomarginals twenty-four, covered with granules, of which median are largest, marginal becoming filiform; on plates six to nine several of these granules are larger than the rest, and on plates ten to eighteen the central one of these becomes a small, thick, blunt spine, placed on outer, distal corner of plate. Paxillae small, about fifteen longitudinal series at base of arm, with ten to twenty thick, blunt spinelets, of which marginal tend to be slender and central tend to be granules. Madreporic body large, bare, less than its own width from marginal plates.

Interradial areas each with about thirty plates, forming four series on each side; the first extends to the sixteenth or seventeenth adambulacral plate, the second to the seventh, the third to the fifth; these plates carry tufts of spinelets, the central one larger than others, much longer, flattened, somewhat spatula-like, wanting on first series. Lower marginal plates with numerous, filiform spinelets around margin, and fifteen to eighteen more or less flattened spines

(4) σύντομος=*cut short, brief*, in reference to the relatively short arms.

on surface; these vary much in size, but four form a series obliquely across upper end of plate, with uppermost adoral, and lowest, most distal; two uppermost about equal in size, the two lower a trifle shorter and three about equal to four; these spines are about 3 mm. long, scarcely ½ mm. wide, somewhat flattened, acuminate; they form, of course, a conspicuous marginal fringe; above,

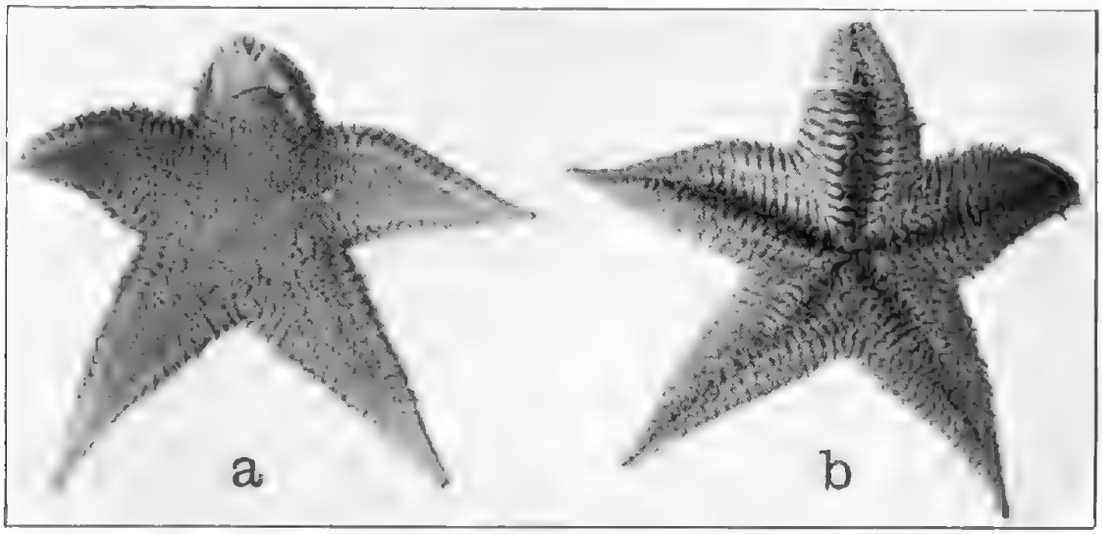

Fig. 110. *Astropecten syntomus;* a, aboral view; b, oral view of holotype (nat. size).

increasing the density of the fringe, are four similar but smaller spines. Adambulacral armature made up of a marginal or furrow spine, and several spines in irregular pairs on surface of plate. Oral plates well covered with spines, eighteen to twenty on surface of each half; they are blunt, distal ones small, proximal two or three, especially innermost, rather large; there are seven marginal spines on each side, of which the innermost is much the largest. Colour (dry), pale yellowish-brown.

Holotype: Reg. No. E. 409.

There is only a single specimen of this well-marked species, and it has no locality label. It is obviously allied to the Tasmanian species, *A. schayeri* Döderlein, but is easily distinguished by the character of the armature on the marginal plates, both upper and lower; the arms are also more attenuate than in *A. schayeri*, with more superomarginals; there are many more actinolaterals and there are fewer surface spines on the adambulacral plates.

ASTROPECTEN VAPPA.

Müller & Troschel, Arch. f. Naturg., ix, 1843, p. 119.

There is a small sea-star, with R = 14 mm., from an unknown locality, which I think may well be considered a young example of this species. Döderlein,

in his admirable monograph on the genus *Astropecten* (1917), has cleared up the confusion between this species and *A. pectinatus* Sladen. Both species occur on the coast of south-eastern Australia, and in both my "Thetis" and "Endeavour" reports I failed to distinguish them, as no adequate description or figure of *A. vappa* was then extant.

FAMILY LUIDIIDAE.

LUIDIA Forbes.

LUIDIA AUSTRALIAE.

Döderlein, Siboga Rep., lxxxviii, Mon. 46 b, 1920, p. 266.

There are seven specimens, each with seven arms, all adult. All but one are typical of this southern species, recently separated from the long-known *L. maculata* M. & T. of Asiatic coasts, and this one shows the distinctive species character clearly. Döderlein *(l.c.)* suggests that *L. australiae* may be regarded as only a local form of *L. maculata*, and gives in his key (p. 235) two points of difference, one in the form of the arm, the other in the character of the paxillae near the tip of each arm. Examination of all the adult specimens available to me (eleven from Australia and three from Hong Kong) has satisfied me that the Australian species is well established, but I do not see any difference in the form of the arm between it and *L. maculata*. In the character of the paxillae on the distal part of the arm, however, *L. australiae* stands out well, the median paxillae being larger and of markedly unequal size, while the series of lateral paxillae are much less regular and conspicuous than in *L. maculata*. It is worth noting further that all recorded Australian specimens have seven arms, while most specimens of *L. maculata* seem to have eight or nine, though seven-armed specimens are not rare.

Of the specimens in the South Australian collection, five are without locality labels, and one is from St. Vincent Gulf. These specimens have R = 150 mm. to 210 mm., and show little diversity, except that some are much browner than others. The seventh specimen is from between Trowbridge Lighthouse and Kangaroo Island, and was collected by Dr. Verco. All of the arms have been broken at some time, and four have regenerated from 5 mm. to 18 mm. of new arm. On these regenerated tips the colour is the variegated dull yellow and blackish usually shown, but elsewhere the whole dorsal surface is uniformly brown; moreover, the paxillae in this individual are noticeably smaller than usual, but the distal part of the arm shows the characteristic inequality of size.

FAMILY ARCHASTERIDAE.

ARCHASTER Müller & Troschel.

ARCHASTER TYPICUS.

Müller & Troschel, Monatsb. k. preuss. Akad. Wiss, 1840, p. 104.

A single specimen, with R = 65 mm., nearly white, dry, but in fine condition, is from Port Essington, Northern Territory.

FAMILY GONIASTERIDAE.

NECTRIA Gray.

NECTRIA MULTISPINA (5) sp. nov.

R = 80 mm. to 85 mm.; r = 30 mm. to 32 mm.; br (at very base of arm) = 35 mm. R = 2·7 r ±. Disk covered with large tabulate plates, having four to six sides, though the angles may be rounded; these plates are largest on the radial areas of disk, where they may be as much as 7 mm. across; upper surface of arms covered with smaller, lower, nearly circular plates of diverse sizes, the larger separated from each other by the smaller; all plates more or less convex (largest with rather flat tabulum), and covered by swollen, hemispherical or polygonal granules of unequal size; on the smaller plates one or more of the granules are very much larger than those around the margin, while on the larger plates there is a series of small marginal granules, and the rest of the plate is covered by six to twenty large, closely appressed, polygonal, convex granules, of which one to six at centre are much the largest, and may be 1·5 mm. to 2 mm. across. Marginal plates distinct, about thirty-two or thirty-three in each series, on each side of ray; proximally the plates are higher than long, and covered with fifty or more coarse granules, subequal in size, but distally they become squarish, and some of the central granules become enlarged, polygonal, appressed.

Actinal intermediate areas moderate, with more than one hundred plates, but half of these are in the series adjoining the adambulacrals, extending out about two-thirds the length of the arm; remainder arranged in three or four series, of which the first extends out to the seventh inferomarginal or further, and the last is confined to the vicinity of the first two marginals; all these plates are covered with coarse granules (few and very coarse on distal plates); on

(5) *Multispinus*=having many spines, in reference to the adambulacral armature.

several of the proximal plates of the first series a conspicuous, very stout, erect pedicellaria is present, with two to four, usually three, wide, blunt or truncate jaws; pedicellariae were not detected elsewhere.

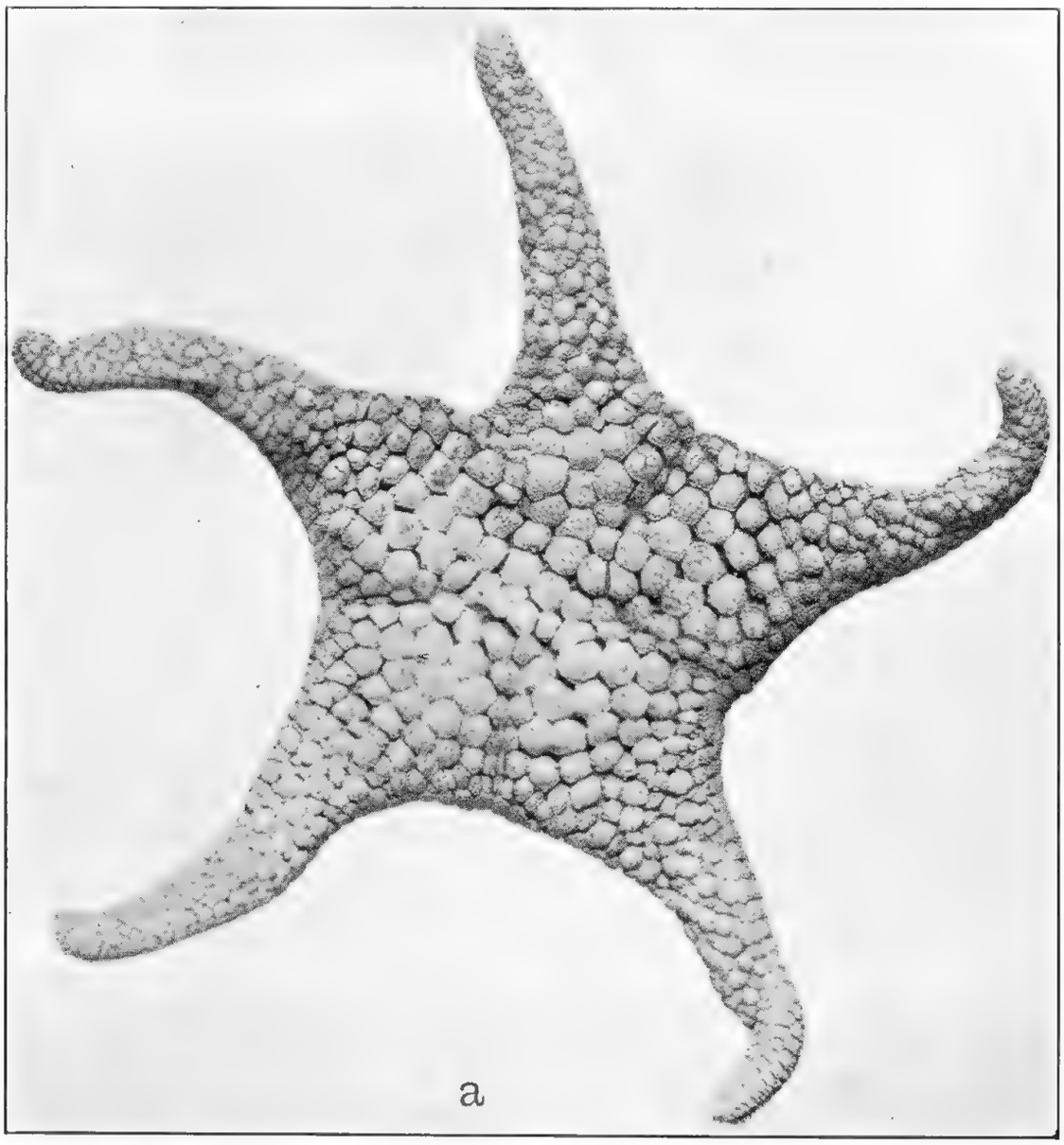

Fig. 111a. *Nectria multispina*, aboral view of holotype (4/5 nat. size).

Adambulacral plates with six furrow spines, becoming five and even only four distally, and three short, stout, prismatic spines on the surface of each plate; middle furrow spines longest, 2·5 mm. or more; adoral spine decidedly shortest, flattest, and widest; all furrow spines more or less prismatic, with angles and tips rounded. Oral plates with nine marginals, innermost very stout;

on surface of each plate four low, stout, prismatic but round-tipped spines; on distal part of each plate are several similar but much smaller spines. Colour (dry), brown.

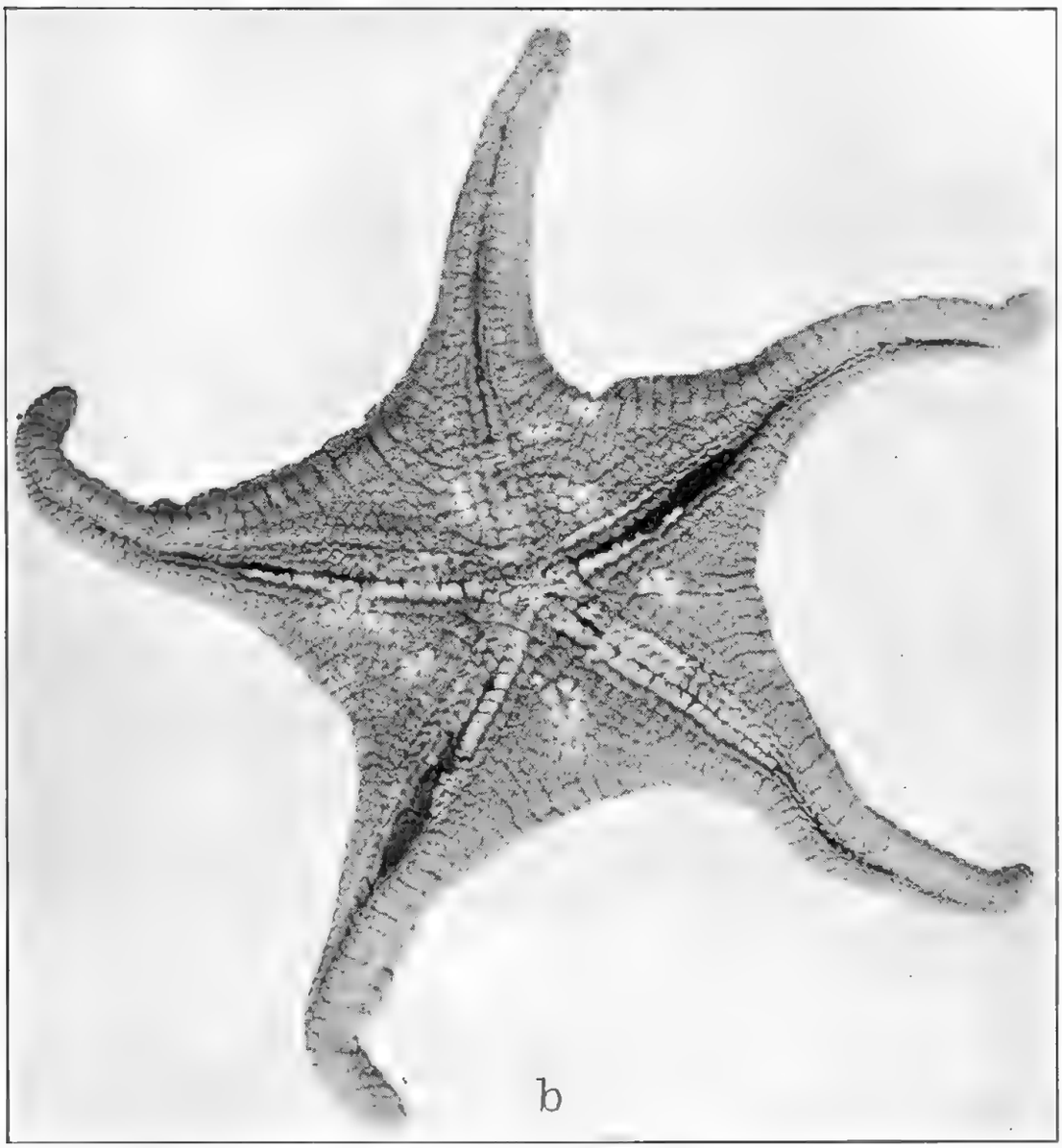

Fig. 111b. *Neelria multispina*, oral view of holotype (4/5 nat. size).

Holotype: Reg. No. E. 413.

There are three paratypes, which show no important differences, except such as might be expected from their smaller size, as R = 57 mm. to 65 mm. The adambulacral armature shows only five furrow spines proximally, four distally, while on the surface of the plate there are three or more smaller spines

as well as the three large ones; proximally the three smaller spines stand in a series back of the three larger, and both are parallel to the furrow series, but distally the arrangement is less and less regular. In the smallest specimen the oral plates have their spines very regularly arranged (it is less easy to make out in the larger specimens); there are eight spines on each proximal margin, innermost largest; back of these is a series of four (on one side, five on the other) short, very stout spines; running along distal margin of plate is a series of similar but much smaller spines, five on one side, four on other; these series converge, of course, so that the distalmost spines of the two series are side by side; within the area enclosed by these regular series are two to four, usually three, small, blunt spines, like the distal marginals.

There is no locality label with these specimens, but as they are said to have been taken by "Dr. Verco, February, 1891," it seems almost certain that they were collected in either Spencer or St. Vincent Gulf. They differ strikingly from the other species of *Nectria* in the character of the dorsal tabulae, in the adambulacral armature and oral plates, and in the pedicellariae.

NECTRIA OCELLATA.

Perrier, Arch. Zool. Exp., v, 1876, p. 4.

There are twenty-eight specimens of this well-known species, from Spencer and St. Vincent Gulfs, from Granite Island, Victor Harbour, and from unknown localities. They have been of great value in enabling me to understand the specific limits in the genus. They range in size from young ones with R only 6·5 mm., to large adults, in which R = 90 mm. and more. In all, regardless of size, the dorsal tabulae are more or less nearly circular, only very rarely sufficiently near together to become somewhat polygonal through mutual pressure, and are covered by more or less hemispherical granules, which are rarely so crowded as to be in contact; in a few cases granules at or near the centre of the tabula are conspicuously larger than those nearer the margin, but they are never so crowded, so sharply polygonal, or so large as in *N. multispina*. In the smallest specimen there are three adambulacral furrow spines on the most proximal plates, and there are no more in the largest specimen; this seems to be a very constant specific character in *N. ocellata*.

In order that the specific characters of the five forms of *Nectria* now known may be made clear, I venture to offer the following key. I cannot agree with Fisher that my *Mediaster monocanthus* is better placed in *Nectria*, and hence I do not include it.

KEY TO THE SPECIES OF *NECTRIA*.

a. Furrow-spines of adambulacral armature, two to four, usually three; no conspicuous pedicellariae on actinal plates near mouth.

b. Disk large, R = 2·5 to 3 r or br; rays wide at base tapering rapidly to tip; actinal plates with rounded granules, not usually so crowded but that the series of plates are easily seen.

c. Dorsal tabulae with rounded or polygonal granules, often crowded, the marginal ones thick, not flattened.

d. Pedicellariae few or wanting; when present on adambulacral plates, they have three or four wide, blunt (or truncate) jaws .. .. .. *ocellata*

dd. Pedicellariae numerous; those on adambulacral plates with four to six pointed, spine-like jaws .. .. *pedicelligera*

cc. Dorsal tabulae with flat "granules" of very irregular shape and unequal size, not at all crowded; the marginal ones conspicuously flat and scale-like, forming a regular, radiating, marginal fringe .. *ocellifera*

bb. Disk smaller, R = 3·5 to 4 r or br; rays narrower at base, less tapering; actinal surface covered with crowded, coarse, prismatic granules, obscuring the series of actinal, intermediate plates .. .. *macrobrachia*

aa. Furrow-spines, five to six; conspicuous pedicellariae present on first series of actinal intermediate plates proximally; dorsal tabulae covered by large, closely appressed granules, of which one to six at centre are much the largest, 1 mm. to 2 mm. across .. .. *multispina*

In reference to section a of the above key, I may say that it is not clear from Mortensen's ([6]) description and figures whether such pedicellariae are present in the New Zealand species, *pedicelligera,* or not, but the other pedicellariae of that species are surely distinctive. In addition to the peculiarities of the pedicellariae, the adambulacral armature of the New Zealand form indicates that Mortensen is right in regarding it as a separate species, but the dorsal plates and their covering granules, and the size and number of the marginal plates are not essentially different from some Australian specimens of the same size. Attention must be called to the striking difference in covering of the dorsal tabulae as described by Mortensen, and shown in his figure 9b (p. 293), and as revealed in his photograph (pl. 13, fig. 5). Different specimens from Australia

([6]) Mortensen, Vid. Med., lxxix, 1925, pp. 291-293.

show a similar diversity, but how the unique holotype of the New Zealand species can have such tabulae as shown in fig. 9b without their showing thus in the photograph, is quite incomprehensible.

PENTAGONASTER Gray.

PENTAGONASTER DÜBENI.

Gray, Proc. Zool. Soc., 1847, p. 79.

This typically Australian sea-star is represented by fourteen specimens, of which twelve have no locality labels and two are from Spencer and St. Vincent Gulfs, Verco collection. They range in size from R = 9·5 mm. to R = 67 mm., and in colour from white to deep purple-brown; one specimen is nearly vermilion-red, as in life. In the smallest specimen r = 6·5 mm., hence R = less than 1·5 r; when R = 15 mm., r = 8, or R = a trifle less than 2 r; when R = 32, r = 14, or R = 2·25 r; when R = 65 mm. to 67 mm., r = 25 to 28, or R = 2·32 to 2·7 r; the typical proportion in adult specimens seems to be R = 2·5 r. Pedicellariae are abundant, especially in the large specimens. In the smallest specimen there are four superomarginal plates on each side of each ray, the interradial largest, the distalmost smallest, but in specimens with R = 15 mm. and 25 mm. respectively, although there are still only four plates on each side, the distalmost is as large as the interradial, or even larger. In specimens with R = 30 mm. to 35 mm. there are five or six plates on each side of a ray, but the distal are smaller than the interradial, and if six are present the sixth is much the smallest. A specimen with R = 40 mm. has five plates on each side of every ray, with the penultimate the largest, while a second specimen of the same size has six plates on each side of a ray, except in one case where there are but five; in this specimen the interradial plates are the largest. A specimen with R = 50 mm. has six plates on six sides, and seven plates on four, with interradial plates largest. A specimen with R = 54 has seven plates on each side of a ray, with interradials largest. When R exceeds 60 mm. there are likely to be eight plates on a side, with the interradials decidedly the largest.

The inferomarginals in the youngest specimens correspond in number and position with those of the upper series, but after R = 30 mm. there are generally (but not always) one or two more plates in the lower series; the additional plate (or plates) is (or are) at the tip of the arm, the distal superomarginal or two overlying two, three, or even four inferomarginals.

The adambulacral armature changes little during growth; there are two (rarely three) furrow spines, and two or three in the series immediately back of the margin, while in the largest specimens there are three (rarely two) furrow spines and three or two spines in the following series.

Pedicellariae are not usually common on the oral side; there are none in the smallest specimen, and only one in one of the big ones; the specimen with the most has sixty-eight, or an average of thirteen or fourteen to each interradial area. In small specimens there are many pedicellariae dorsally, but there are none on the eleven primary plates; in large specimens practically every dorsal plate has from one to six pedicellariae, a total of more than six hundred.

The dorsal plates are often, if not usually, quite flat, but they may be somewhat convex; particularly the primary plates and the proximal carinals tend to be somewhat convexly elevated. In one specimen the dorsal plates are all more or less convex, while the first carinals and the large interradials are so markedly elevated that it would be but a step to low tubercles. Possibly specimens occur with such tubercles (as in *P. stibarus*), but none are recorded, so far as I know.

Mortensen (7) suggests that my *Pentagonaster stibarus* from Western Australia is identical with *Astrogonium crassimanum* Möbius. While this is possible, there are three differences at least that must be reconciled before *P. stibarus* is abandoned. In the Western Australian species the primary plates, particularly the central one, tend to carry tubercles, or at least to be quite convex; nothing of this sort shows in Möbius's species. In *P. stibarus* there are many more plates both dorsally and ventrally, particularly on the rays and in the actinal interradial areas. Finally, in *P. stibarus*, even in the young specimens, there are three adambulacral spines in both the furrow series and the one back of it, while in *A. crassimanus* there are but two.

TOSIA Gray.

TOSIA AUSTRALIS.

Gray, Ann. Mag. Nat. Hist. (1), vi, 1840, p. 281.

The large number of *Tosias* in the collection has been a source of difficulty, because of the difference in appearance of the two extremes of the series, and the completeness of the intergradation between those extremes. On the one hand are those which have the marginal plates only slightly convex and the terminal pair on each ray not at all swollen. On the other hand are those with strongly convex marginals, and having the terminal pair conspicuously swollen. There does not seem to be any other difference worthy of note between the two extremes. The first extreme is evidently typical *T. australis*, while the other is surely *Astrogonium astrologorum* Müller & Troschel. After a careful examination of the whole series, it seems to me worth while to retain the name *astrologum* for

(7) Mortensen, Vid. Med., lxxix, 1925, p. 285.

those individuals with conspicuously convex marginal plates, but I am confident that they are merely a variety, and by no means a valid species.

I am referring to typical *T. australis* 107 specimens, ranging in size from 8 mm. across (R = 4 mm. ±) to 72 mm. (R = 38 mm.). There is a reasonable amount of constancy in the number of superomarginals, as eighty-two specimens, including all the very small ones, have just thirty, six on each side of the body, and thirteen others have six on each of four sides. There are three specimens with eight on each side, another has eight on each of four sides, and another has eight on each of three sides. There are seven specimens with only five plates on one side, but there is no case of five plates on more than one side, and twenty-nine supero-marginals is the smallest number noted in any specimen, save one extreme aberrant described later. The specimens with only five plates on one side are all less than half grown. The three specimens with eight plates on each side are perfectly symmetrical; one is 26 mm. across, and has only eight or nine inferomarginals on each side; another is 39 mm. across, and has twelve inferomarginals on each side; the third is 63 mm. across, and has fourteen inferomarginals on each side, and the additional marginal plates in both series are distal, small, and symmetrically placed, obviously a normal addition with the increased size.

While there are several cases of half-plates, or still smaller fragments inserted in the marginal series, there are only four aberrants that call for special comment. In one there are six plates on each of four sides, while on the fifth side there are nine plates, with a half-plate and a still smaller fragment just below the antepenultimate plate; this specimen also has a nearly circular madreporite about 6 mm. across, double the normal size. Another specimen has one side badly deformed, with ten and a half supero- and fifteen and a half inferomarginals. Then there is an individual which is hexagonal in outline, with six superomarginals on each of three sides, five on a fourth side, four on a fifth, and only three and a half plates on the sixth side; seen from below, there are only five ambulacral furrows at the mouth, but 4 mm. out, one of these forks, giving rise thus to the hexagonal form. Finally there is an extraordinary specimen, about 50 mm. across, in which the marginal plates are greatly reduced in number. In interradius 1 (Loven's system) there are two superomarginals, three inferomarginals, and three marginals which may belong to either series, but only two inferomarginals lie below superomarginals; in 2 there is one superomarginal with an inferomarginal below it, one distal marginal that from its size and form evidently belongs in the upper series, three large plates that may belong in either series, and three, or perhaps four, small distal plates, of which only one is an inferomarginal; in 3 there are only two large marginal

plates, of which one is a distal superomarginal, the other doubtful, but there are three or four plates which are probably small marginals, and two of these belong to the lower series; in 4 there is one superomarginal, three subjacent inferomarginals, and five large marginals that may be either series; in 5, there are two superomarginals with four subjacent inferomarginals, three plates of uncertain position, and two or three small distal plates, of which one is probably an inferomarginal. In this specimen, then, there are not more than forty-five marginal plates, instead of the ninety that it should have.

Orienting the specimen, according to the madreporite, calling the ray opposite that plate anterior, or orienting according to the Loven system for echini, calling the ray to the left of the madreporite anterior, we do not find that there is any evident correlation between variations in the marginal plates and the anteroposterior axis; there are eight variations in one area, nine in a second, eleven in each of two others, and fourteen in the fifth. The fewest are in interradius one of Loven, the most in interradius three.

In the smallest specimen the distal marginals of each ray are the smallest, and the terminal plate is relatively large; there are six inferomarginals on each side, and each one corresponds exactly to the superomarginal above it. With growth, however, the distal superomarginal becomes the biggest, and this is indicated in a specimen only 11 mm. across, but the inferomarginal series has added another plate at each end, so we now have forty inferomarginals to thirty in the upper series. In a typical half-grown specimen, 36 mm. across, there are fifty inferomarginals, the distal three on each side of each ray underlying the large terminal superomarginal; the four median plates of the two series corresponding to each other in position exactly as they did in the youngest specimens. In typical full-grown specimens there are sixty inferomarginals, four distal ones underlying the distal superomarginal, and in those cases where there are fourteen inferomarginals on a side, five distal ones are overlain by the very large distal superomarginal. All these facts go to show that growth is provided for in the case of the superomarginals by increasing the size of the plates, especially the distalmost, while in the case of the inferomarginals, although the median ones make some increase of size, so as to maintain their relation with the plates above them, growth is chiefly provided for by additional plates distally.

Obviously *Tosia australis* is a common sea-star on the South Australian coast, and the following localities are represented in the present collection: St. Vincent Gulf, Spencer Gulf, Kangaroo Island, Port Lincoln, off Althorpe Island, Wallaroo.

TOSIA AUSTRALIS var. ASTROLOROGUM.

Astrogonium astrologorum, Müller & Troschel, Sys. Ast., 1842, p. 54.

I am labelling with this varietal name thirty specimens which are recognizable by their swollen distal superomarginal plates and their correspondingly less pentagonal form. This is best illustrated by comparison of two specimens in which R = 30 mm. In the typical *T. australis* r = 24 mm., and the distal superomarginals are hardly 6 mm. long and less than 4 mm. high; in *T. astrologorum* r = 20 mm., and the distal superomarginals are 8 mm. long and over 4 mm. high. Of course these two individuals look very unlike, but there are all degrees of intergradation, so I cannot believe they are essentially different. It is doubtful whether the use of even a varietal name is justifiable, for it is certain that specimens of *T. astrologorum* occur in the same lots with typical *T. australis*, but the question must be settled at the shore and not in the museum.

Of the thirty specimens called *T. astrologorum*, the smallest is 13 mm. across, and has thirty supero- and forty inferomarginal plates; the largest is 58 mm. across, and has thirty-two supero- and fifty-seven inferomarginals. Only nineteen of the thirty have thirty superomarginals; four have thirty-one, four have thirty-two, and three have thirty-seven; those with thirty-seven have eight on each of two sides, and seven on the others. Not a specimen shows only five superomarginals on one side. In several specimens the median superomarginals (*i.e.*, those not terminals) are so elevated as to appear as though they bore a blunt tubercle.

The localities represented are Spencer and St. Vincent Gulfs only, though one lot has the label, "Port Willunga, St. Vincent Gulf."

ANTHENEA Gray.

ANTHENEA FLAVESCENS.

Hosia flavescens Gray, Ann. Mag. Nat. Hist., (1), vi, 1840, p. 278.
Anthenea flavescens Perrier, Arch. Zool. Exp., v., 1876, p. 92.

A single *Anthenea*, bearing the label "North Australia," seems to be the adult of this little-known species. It resembles Döderlein's var. *nuda* (8) in the deficiency in dorsal pedicellariae, but I believe that the number and arrangement of the dorsal pedicellariae are subject to great individual diversity, and are also influenced by age, so I doubt the validity of *nuda* as a constant variety. The present specimen has R = 59 mm. and r = 27 mm., and hence is much larger than any specimen available to Döderlein, yet the number of marginal plates is practically the same, thirteen or fourteen in the upper series and fifteen

(8) Döderlein, Jahrb. Nassau. Ver. Naturk., lxviii, 1915, p. 42.

or sixteen in the lower. On only three or four of the superomarginals is there a pedicellaria, but each one carries a conspicuous tubercle or low capitate spine, and the distal ones have two or even three such tubercles, though they are smaller than those on the proximal plates. Each inferomarginal, except the distalmost one or two in each series, carries a large pedicellaria, besides fifteen to twenty coarse granules and three or four times as many very small ones; many of the plates carry a second smaller pedicellaria, and rarely there is a third; the distalmost plates have only three to ten coarse granules and practically none of the very small ones. The dorsal plates are not easily made out, except on the distal half of each ray. Nearly all of the carinal plates carry small tubercles, but very rarely is there more than one to a plate, and on many plates, especially on the ray opposite the madreporite, even one is wanting. Similar but smaller tubercles, or more properly granules, replace pedicellariae on a large proportion of the adradial and other dorsolateral plates. The actinolateral plates each carry two to seven coarse granules and a large pedicellaria; here and there the pedicellaria is wanting. The armature of a typical adambulacral plate consists of a furrow series of five spines, the middle three subequal, the other two much smaller, and three very stout, blunt spines on the oral surface of the plate, two adjoining the furrow margin, and one behind them; this third spine is often wanting; of the marginal pair the distal one is usually the larger, and near the tips of the rays is the only one present. On some of the adambulacral plates near the mouth a pedicellaria is present on the adoral side. It is evident that the adambulacral armature in the present specimen is much more like that given by Döderlein for typical *A. flavescens* than it is like what he found in his variety *nuda*.

It seems to me fair to conclude that the present specimen is an adult, though not necessarily a full-grown, example of *A. flavescens* (Gray), and that Döderlein's variety *nuda* is within the limits of the normal variation of the species.

ANTHENEA TUBERCULOSA.

Gray, Proc. Zool. Soc., xv, 1847, p. 77.

This paper of Gray's was also printed verbatim in the Ann. Mag. Nat. Hist., xx, 1847, p. 198 (not vol. x as given by Döderlein, 1915, *op. cit.*). The Royal Society Catalogue gives precedence to the P.Z.S. paper; in fact, in this particular instance no reference is made to the publication in the Annals.

There are four specimens of this common North Australian species, but only one has a locality label, and that one is merely from "North Australia." Although they range in size from R = 50 mm. to R = 90 mm., they show very little diversity, but agree well with Döderlein's (1915, *op. cit.*) description and figures.

ANTHASTER Döderlein.

ANTHASTER VALVULATUS.

Oreaster valvulatus Müller & Troschel, Arch. Naturg., ix, 1843, p. 115.
Anthaster valvulatus Döderlein, Jahrb. Nassau. Ver. Naturk., lxviii, 1915, p. 30; pl. iii.

This remarkable sea-star has been known hitherto only from the holotype, which is in Berlin, and was collected by Preiss in "South-west Australia." It has R = 107 mm., and has been admirably redescribed and figured by Döderlein. The presence of thirteen specimens in the collection before me is therefore of great interest, and some notes upon them will be of interest. While they agree in the main with Döderlein's description and figures, they show some differences in the dorsal and marginal tubercles and in the adambulacral armature.

The smallest specimen, labelled "*Goniodiscus seriatus* M. & T., Kangaroo Island," has R = 42 mm. and r = 21 mm. A second specimen with it from the same locality is only a trifle larger. The pedicellariae show that they are not *Goniodiscus seriatus,* but are young *Anthasters.* In the smaller individual the only dorsal tubercles are five, placed one at the base of each ray on the most proximal plate of the carinal series; in the larger specimen there are some additional tubercles on other carinal plates, two to four on each ray, but only three or four of these are big enough to be at all noticeable. There are twelve superomarginal plates on each side of each ray, and only the four or five distalmost have tubercles large enough to mention; nearly every plate has a pedicellaria, and often there are two. The inferomarginals are essentially the same as the upper series in number, size, and general appearance, but their pedicellariae are somewhat larger though scarcely equal to those occurring on nearly all of the actinolateral plates. In the adambulacral armature there are eight spines in the furrow series, though the first and last are very small; there are three short, wide, blunt spines in the second series, and two or three much smaller ones in the outermost row; there is usually a pedicellaria on the adoral margin of each plate.

The largest specimen has R = 112, r = 52, and breadth of arm at middle about 40 mm. There are fifteen superomarginals in each series, and the same number in the lower series. In appearance and tuberculation they are like those of the smallest specimens. Dorsal tubercles rather numerous, occurring on most of the carinal plates, most of the disk plates, and on many other plates at the base of the rays, but they are rarely present on the distal part of the rays. The adambulacral armature is similar to that found in the smaller specimens, but there are often nine spines in the furrow series. All the spines

are stouter, particularly those on the oral surface of the plate, where there are often three series, though the outermost may consist of only a single spine.

The specimens of intermediate size are very similar to the others. The chief diversity is in the number and conspicuousness of the dorsal tubercles, for there is very little diversity in the armature of either the marginal or adambulacral plates. One specimen with R = 80 mm. has only nine or ten dorsal tubercles, while another with R = 77 mm. has about 180. In all cases the five primary tubercles are the largest, but they are seldom more than 3 mm. high, and their basal diameter is about equal to the height. They are thus much smaller than in Müller & Troschel's type.

All of the specimens are "museum colour," dull yellowish or brown of some shade, but there are two plaster casts in the collection which were evidently painted to show the colour in life. These are both a deep violet-red above, but one is pure white (unpainted) on the oral surface, while the other is coloured a fine salmon-red along the ambulacra, with a slight violet tinge to the red of the interradial areas. It is possible that there is considerable diversity in the colouring of the oral side, but it is not at all likely that it is ever pure white.

The species is apparently common on the South Australian coast, but the only definite localities indicated besides Kangaroo Island are St. Vincent Gulf, Althorpe Island (Dr. J. C. Verco), Glenelg (Mr. A. T. Beaumont), and South Australian coast (W. J. Conroy).

FAMILY OPHIDIASTERIDAE.

AUSTROFROMIA H. L. Clark.

AUSTROFROMIA POLYPORA.

Fromia polypora H. L. Clark, *Endeavour* Res., iv, 1916, p. 51; pl. xiv, figs. 1 and 2.

Austrofromia polypora H. L. Clark, Dept. Mar. Biol. Carn. Inst., X, 1921, p. 48.

There are three specimens of this imperfectly known species, but unfortunately not one of them has a locality label. The smallest has R = 65 mm., and the colour (in alcohol) is reddish-buff, suggesting that the species is more or less red in life. The other specimens are dry, and much larger than any previously known. In one R = 95 mm., r = 19 mm., and br = 19 mm., hence R = 5 r or br. The other has R = 112 mm., r = 22 mm., and br = 27 mm., hence R = 5 r but only 4 br. In the smaller specimen the rays are very little flattened, but are quite terete, while in the larger there is a little more indication of flattening, but it is not at all marked. In each specimen the actinal interbrachial areas are so large that there are five, and possibly six, series of

actinolateral plates, but owing to the close granulation of all plates it is not easy to make out the various series, and even the marginal plates are much obscured. The colour of these dry specimens is bright brown, with a yellowish tinge; in the larger one the disk and bases of the rays on the upper surface are almost black, and this dark colour extends orally on three rays almost to the ambulacral furrow, but it does not approach very near to the mouth; in the smaller specimen this dark area is only faintly indicated on the upper part of the bases of the rays, the greater part of the disk being quite free from it. After careful examination I am led to believe that this dark colour is not normal, but is due to some oily material, perhaps the stomach contents or a secretion from the hepatic glands, which has stained the specimens.

FAMILY ASTEROPIDAE.

PETRICIA Gray.

PETRICIA VERNICINA.

Asterias vernicina Lamarck, Anim. s. Vert., ii, 1816, p. 554.
Petricia vernicina Fisher, Zool. Anz., xxxiii, 1908, p. 357.

A fine series of thirty-four specimens ranges in size from R = 30 mm. to R = 58 mm. There is considerable diversity of form, aside from the differences caused by preservation. At one extreme is a specimen with R = 50 mm., r = 25 mm., and br at $\frac{1}{2}$R = 24 mm.; at the other is a specimen with R = 55 mm., r = 25 mm., and br at $\frac{1}{2}$R = 18 mm.; most specimens are intermediate between these two extremes. Most of the alcoholic specimens are dull red-brown in colour, but a few are light yellowish-brown, or even a dirty cream-colour; dry specimens are dirty white, yellow-brown, red-brown, or very dark red-brown.

As regards the big pedicellariae characteristic of the genus, there is the greatest diversity; there should be one in each actinal interradial area, near mouth, and one at the base of each ray, on each side dorsally, fifteen in all, five oral and ten aboral. But this symmetrical condition is very rare, and is shown by only one of the thirty-four specimens. Only one other specimen has five oral pedicellariae, and fifteen specimens lack them altogether; four specimens have four, four have three, five have two, and four have a single one; thus the thirty-four specimens average only one and a half oral pedicellariae apiece. There are six specimens which have ten aboral pedicellariae, one has eleven, and one has twelve; two have nine, two have eight, three have seven, three have six, two have five, four have four, six have three, one has two, two have but one, and one specimen has none at all; thus the thirty-four specimens average only

six aboral pedicellariae each. The individual with twelve aboral pedicellariae is symmetrically six-rayed, with R = 43 mm., but it has only two oral pedicellariae. It is interesting, though probably not significant, that five individuals have no oral and only three aboral pedicellariae. It must be said, however, that twenty-eight of the thirty-four *Petricias* are in alcohol, and many of them are more or less distorted; hence, owing to the thick, fleshy skin which covers the whole animal, the aboral pedicellariae are often difficult to detect, and it is not unlikely that some have been overlooked. Their presence does not seem to be correlated in any way with size; in the smallest specimen there are two oral and seven aboral pedicellariae, while in the largest there are no oral and only four aboral; there is, however, no indication that the pedicellariae tend to decrease or disappear with age.

Unfortunately there are no locality labels with any of the specimens except the smallest, which was taken by Dr. Verco in Spencer or St. Vincent Gulf.

ORDER SPINULOSA

FAMILY ASTERINIDAE.

ASTERINA Nardo.

ASTERINA ATYPHOIDA.

H. L. Clark, "Endeavour" Res., iv, 1916, p. 57.

There is a fine series of thirty-nine specimens of this little-known but easily recognized species; the smallest are about 12 mm. across, while the largest are 22 mm., and thus somewhat bigger than the original specimens. One of the 22 mm. specimens has R = 11 mm. and r = 11 mm., and is thus almost circular in outline, but another has R = 11 mm. and r = 10 mm., and is distinctly pentagonal. There is little diversity in the appearance of the upper side, but some individuals have more than others of the pointed granules along the proximal margins of the plates. Orally there is very little diversity, the species characters seeming to be remarkably constant. There is no hint as to the colours in life, all of these specimens being "museum colour," ranging from nearly white to pale brown, usually yellowish, occasionally reddish.

Most of the specimens (twenty-three) are from "Spencer or St. Vincent Gulf," but eight are from "between Trowbridge Light House and Backstairs Passage," seven have no locality label, and one is from "between Backstairs Passage and the Pages, 1888."

ASTERINA CORONATA FASCICULARIS.

Fisher, Bull. 100, U.S. Nat. Mus., iii, 1919, p. 414.

There are three dry, dull-coloured specimens of this little-known species, bearing the labels, "N. Territory" and "North Australia." Fisher *(l.c.)* lists an *Asterina* from Port Essington as of this subspecies. The present specimens have five rays each, and R ranges from 20 mm. to 30 mm. There are about fifteen to twenty-two enlarged abactinal plates on each ray, but these are conspicuous more for their elevation than for their size. There are six to eight oral (marginal) spines, usually six furrow spines (occasionally one or even two more), and four to six, usually five, pointed spinelets in a group on each actinal intermediate plate, of which one or two are distinctly larger than the others. Pedicellariae such as Fisher describes and figures for the subspecies *euerces* occur in the largest specimen, and are common in one of the smaller ones, but I do not find them in the third, which is, however, rather poorly preserved. These specimens are thus intermediate between the subspecies *euerces* and *fascicularis*, but on account of the actinal intermediate spinelets and the geographical origin I refer them to *fascicularis*. I confess to some doubt, however, as to whether the various subspecies of *coronata* will prove to be recognizable when a considerable amount of material is available for study.

ASTERINA CRASSISPINA (9) sp. nov.

Rays five, rounded into blunt tips; R = 20 mm., r = 11 mm., br. = 12 mm. General form stellate; dorsal plates not imbricating, and with the exception of a few near base of ray, not crescentic; covered with blunt spinelets, scarcely twice as long as thick, forming a rather uniform granular coat all over dorsal side. Papulae rather numerous; a double row along midradial line (*i.e.*, a series on each side of the row in carinal plates), and three or four rows, on each side decreasing in length outwardly, so that the outermost has only two papulae. Madreporite, small, triangular but rounded, very near centre of disk.

Oral surface with rather large interradial areas; actinal intermediate plates each with one or two, usually two, wide, blunt, flattened spines, a millimetre long or less, and almost half as wide as long. No pedicellariae. Adambulacral plates with furrow comb of four subequal spines about 1·25 mm. long and rather slender; on surface of plate are two blunt, heavy spines, like those of the actinal intermediate plates, but somewhat larger. Oral plates with six

(9) *Crassus*=heavy, thick+*spina*=a thorn, spine, in reference to the very stout spines of the oral surface.

marginal spines, innermost longest; on each oral plate is a huge suboral spine, 1·75 mm. long, ·60 mm. to ·75 mm. wide, squarely truncate, flattened. Colour (dry), dull yellowish.

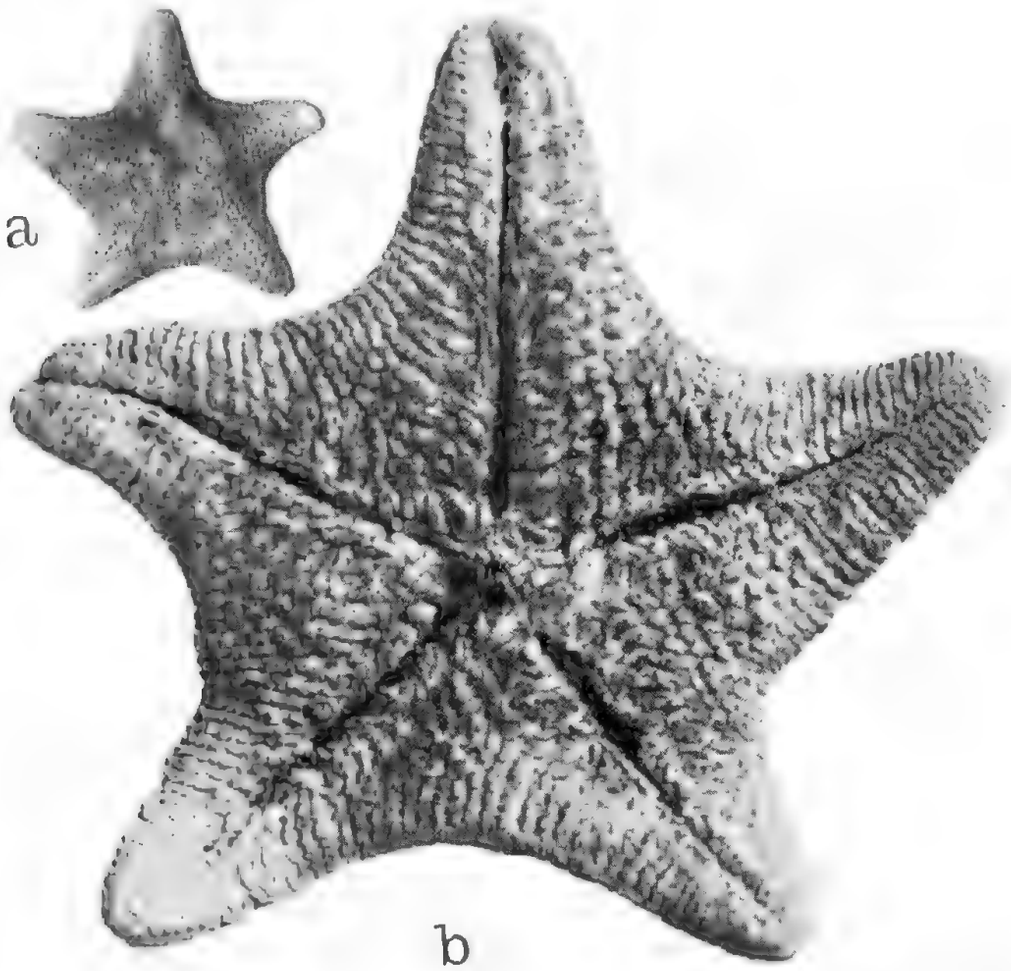

Fig. 112. *Asterina crassispina*; a, aboral view (nat. size); b, oral view of holotype (x 3).

Holotype: Reg. No. E. 425.

The unique type bears the label "N. Australia," indicating that the coast of the Northern Territory is the locality whence it came. It is in rather poor condition, but its distinctive characters are well marked.

PATIRIELLA Verrill.

PATIRIELLA CALCAR.

Asterias calcar Lamarck, Anim. s. Vert., ii, 1816, p. 557.
Asterina calcar Gray, Ann. Mag. Nat. Hist., vi, 1841, p. 290.
Patiriella calcar Verrill, Amer. Jour. Sci., xxxv, 1913, p. 484.

There is a good series of twenty-six specimens of this well-marked species, ranging from R = 16 mm. to R = 54 mm. All have eight rays. The colour ranges from nearly white to dark brown, but there is no hint of the fine colours of life. The localities represented are: New South Wales: Bondi, Zietz coll., 1906, November; South Australia: Guichen Bay, Mr. A. Zietz, 1889, March; Encounter Bay, Dr. R. H. Pulleine, 1886; St. Vincent Gulf, Dr. Verco, 1889; St. Vincent and Spencer Gulfs.

PATIRIELLA EXIGUA.

Asterias exigua Lamarck, Anim. s. Vert., ii, 1816, p. 554.
Asterina exigua Perrier, Arch. Zool. Exp. v, 1876, p. 222 (302).
Patiriella exigua Verrill, Amer. Jour. Sci., xxxv, 1913, p. 484.

This well-known species is represented by twenty-five specimens from: New South Wales, Bondi, 1906, November, A. Zietz coll. (ten); South Australia, St. Vincent and Spencer Gulfs (twelve); Kangaroo Island (two); and North Australia (one). The two specimens from Kangaroo Island and one of those from Bondi have but four rays, while one from Bondi has six rays. All of the specimens are small, ranging from R = 4 mm. to R = 11 mm.; thus the largest is little more than half the size of fully-grown specimens. None show any trace of the colour possessed in life. The species is readily distinguished from *P. regularis*, and, when six-rayed, from small specimens of *P. gunnii*, by the bare, smooth area back of the oral plates in the actinal interradii; this bare area may reach half-way to the margin, and is very characteristic.

PATIRIELLA GUNNII.

Asterina gunnii Gray, Ann. Mag. Nat. Hist. (1), vi, 1840, p. 289.
Patiriella gunni Verrill, Amer. Jour. Sci., xxxv, 1913, p. 484.

The large series of this characteristically Australian sea-star contains 163 specimens, which range in size from R = 7 mm. to R = 70 mm. An equally great diversity is shown in form, in part due to difference in the proportion of R to r, but chiefly due to difference in preservation. In rare cases r = R, and the outline is thus approximately circular; more commonly R = 1·16 r, and the outline is hexagonal; but often the rays are more prolonged, and R = 1·20 to 1·35 r; in extreme cases R = 1·5 r. Dried specimens are often very flat, the vertical diameter not exceeding ·06 of the horizontal; more commonly it is ·10 to ·20, and in some well-preserved specimens rises to ·30 or more, in extreme cases to ·40. Of the 163 specimens, 140 (85%) have six rays, and sixteen (or about 10%) have seven, while there are five with eight rays and one with only five. One specimen has an ambulacral furrow forked half-way between mouth

and tip, so that there are six and a half furrows; seen from above the specimen has seven sides, but two are shorter than the other five. Eight-rayed specimens with long rays might be confused with *P. calcar*, but the paired spines on the actinolateral plates distinguish them at once. Small specimens might be confused with *P. exigua*, especially if there were only five rays, but the absence of the large suboral spine on the mouth plates always distinguishes *P. gunnii*.

All of the present series are "museum colour," ranging from dirty-whitish to very dark brown; one or two show distinctly reddish shades. The localities represented are all in South Australian waters, but most of the specimens have no locality labels; there are specimens, however, from Port Lincoln, St. Francis Island, Althorpe Island, Kangaroo Island, and St. Vincent and Spencer Gulfs, Verco coll. One specimen is labelled "*Asterina regularis* Verrill, New Zealand"; it is, however, a typical hexamerous South Australian *P. gunnii*, and we must interpret the "New Zealand" as merely an indication of the region inhabited by *P. regularis*, with which species this specimen was wrongly identified.

NEPANTHIA Gray.

NEPANTHIA BREVIS.

Asterina (Nepanthia) brevis Perrier, Arch. Zool. Exp., v, 1876, p. 241 (321).
Nepanthia brevis Sladen. "Challenger" Rep., xxx, 1889, p. 387.

There is a single specimen of this fine species from "North Australia." It is fully grown, R equalling 43 mm. It is "museum colour," and shows no trace of the handsome markings possessed when living.

NEPANTHIA GRANDIS [10] sp. nov.

R = 40 mm to 45 mm., r = 23 mm to 25 mm., br = 25 mm. to 29 mm.; R = 1·75 r or 1·6 br.; form more or less markedly stellate; margins, especially in interradii, more or less extended, flattened, and apparently flexible in life. Disk and median portion of rays well arched; oral surface very flat. Rays five (of the twenty-six specimens, three are six-rayed), tapering gradually to a rounded and rather wide tip. Disk and median portion of rays covered by irregularly arranged plates of several sizes, their elevated centres roundish, elliptical, or crescentic, and densely covered with very delicate, glassy spinelets; the elevated part of the plate which carries the spinelets is nearly as high as the length of the spinelets themselves; scattered among these plates are the papulae, often single, especially along margin, but proximal to each of the larger plates on base of rays they are in pairs or groups of three, and on the disk there are from four to seven in a group; in the interradial areas and along the margins

(10) In reference to the size as compared with other members of the genus.

of the rays the plates are much smaller, the elevated portion is more or less circular, and they are arranged in regular, crowded, longitudinal series, among which there are no papulae; in small specimens there are five or six such series on each side of each ray, but in the large specimens the number rises to nine or ten, and the contrast between them and the median area of irregularly arranged plates may be very marked, although, like them, they are densely covered with fine spinelets. Terminal plate rather small and covered with spinelets. Madreporite small, near centre of disk; often overshadowed by its neighbouring plates, and not easy to see.

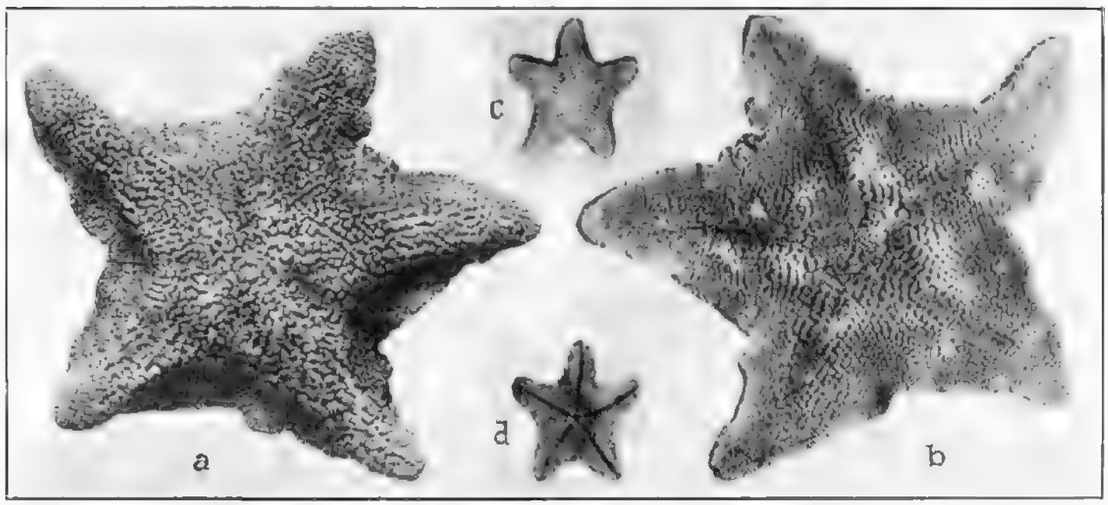

Fig. 113. *Nepanthia grandis;* a, aboral view and b, oral view of holotype; c, aboral view and d, oral view of juvenile (2/3 nat. size).

Oral surface entirely covered by rhombic plates, the outlines of which are indistinct; the centre of each plate is elevated into a circular knob, densely covered with spinelets just like those of the aboral side; the plates are largest just back of the oral plates, and become very small at the margin; they are arranged in definite transverse series, which are, of course, oblique on the interradial areas, but come to be at right angles to the ambulacral furrow on the rays. Adambulacral plates with a furrow series of six to eight blunt, relatively long and stout (actually they are slender) spines, back of which is an equal number of somewhat smaller ones, and back of them, covering the rest of the plate, are numerous slender spinelets, like those of the actinolateral plates. Oral plates very similar to the adambulacral, but the eight marginal spines are larger, especially those at tip of jaw; surface of plate well covered with spinelets. Colour ranges from nearly white to deep reddish-brown, but there is no indication of what it may have been in life.

Holotype: Reg. No. E. 430.

There are twenty-six specimens at hand of this somewhat perplexing form, which I have placed in *Nepanthia*, in spite of its relatively large interradial areas, because the skeleton, the covering of spinelets, and the adambulacral armature all seem to indicate its position in that genus. The smallest specimens have R only 7 mm. or 8 mm., and are very *Asterina*-like in appearance, but careful examination shows they are essentially like the adults. The largest specimen has R = 60 mm. and r = 25 mm., hence R = 2·4 r; there are eight to eleven furrow spines on the adambulacral plates. Of the six-rayed specimens two are very small, but one has R = 40 mm.; it is fairly, but not perfectly, symmetrical. All of the specimens are apparently from the South Australian coast, chiefly Verco collections from Spencer and St. Vincent Gulfs; one small specimen bears the label "Tumby Bay."

FAMILY ECHINASTERIDAE.

ECHINASTER Müller & Troschel.

ECHINASTER ARCYSTATUS.

H. L. Clark, Rec. W. Aust. Mus., i, 1914, p. 148.

This species, hitherto known only from the holotype, taken on the Western Australian coast, is apparently not rare in South Australian waters, for there are four specimens in the present collection. Unfortunately only one has a definite locality label; this reads, "Between Backstairs Passage and the Pages. Dredged in 25 fathoms. Field Nat. Exp., April, 1888." This specimen has R = 65 mm., and is very well preserved, while two others of about the same size are in less satisfactory condition. The fourth specimen is a very large one, with R = 172 mm. and r = 22, so that R is almost equal to 8 r. In the smaller specimens, and in the original holotype, R = 6·5 r. The arms are very slender on the big individual, with br = 24 mm. at base of arm and only 16 mm. at middle, hence R = 7 br at base, and almost 11 br at middle of arm; in the smaller specimens R = 4 or 5 br at base and only 6·5 br at middle. All of the specimens are dull brown in their dried condition, but there are indications that the colour in life is deep red or red-brown.

ECHINASTER GLOMERATUS.

H. L. Clark, "Endeavour" Res., iv, 1916, p. 62.

There are three dry specimens of this species, originally found near Kangaroo Island; two are without locality labels, while the third was taken "Between Backstairs Passage and the Pages. Dredged in 25 fathoms. Field

Naturalists' Exc., April, 1888"; it is thus from the same place, and taken at the same time as the specimen of *E. arcystatus*, referred to above. Like the latter it is in excellent condition, being admirably preserved; it has R = 100 mm., r = 20 mm., and br = 20 mm.; the heaps are very conspicuous, and the spinelets taller and sharper than in the holotype. The colour is a bright yellow-brown, not at all suggestive of a red colouration in life. The other two specimens are not in such good condition, as they are crusted over with some foreign material, having apparently dried with the evaporation of the spirits in which they were preserved; one was, in life, evidently much like the specimen from Backstairs Passage, but the arms are relatively wider at base (R = 97, but br = 25 mm.), and more tapering; the other has R = 90, br = 18 mm., and arms tapering little, but its chief peculiarity is that the "heaps" bear more numerous, shorter, and blunter spinelets; this specimen thus approaches the variety *extremus*, described beyond.

Besides the dry specimens there are four in alcohol, two without locality labels, and two from the Verco collections in Spencer and St. Vincent Gulfs. The two without locality are in rather poor condition, and are of such a light brownish-yellow there is little doubt that they have been bleached by the alcohol; in one, R = 80 mm., br = 19 mm., and the arms are flat and tapering, while in the other, with R = 75 mm. to 80 mm., and br = 17 mm. to 18 mm., the arms are stouter, more cylindrical, and less tapering. The Verco specimens are smaller and in better condition; one has R = 55 mm. to 60 mm., with br. = 11 mm. to 12 mm., and is bleached to a very pale brownish-yellow; the other has R = 65 mm. to 75 mm., with br = 15 mm. to 16 mm., and the colour is yellow-brown; both specimens are quite typical.

ECHINASTER GLOMERATUS var. EXTREMUS (11) var. nov.

R = 60 mm., r = 12 mm., br = 12 mm., R = 5 r or br. Rays nearly cylindrical, tapering but little. Heaps of spinelets, numerous, very large, in seven to nine longitudinal series, with four to twenty or more short, stout, blunt spinelets or coarse granules; three to nine papulae in each area. Colour, yellow-brown.

Holotype: Reg. No. E. 432.

This specimen has no locality label, but there is no reason to doubt that it came from South Australian seas, probably from St. Vincent or Spencer Gulf. The general appearance is so striking it seems desirable to give the form a name, though it probably intergrades completely with the typical form.

(11) In reference to the extreme development of the heaps of spinelets.

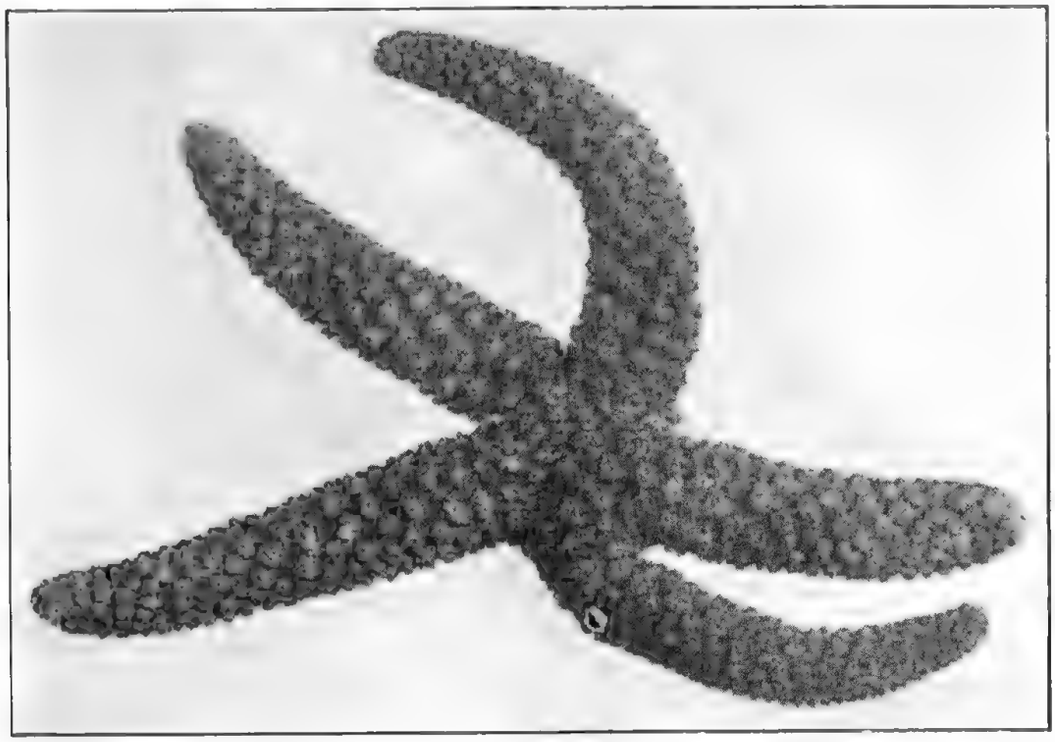

Fig. 114. *Echinaster glomeratus* var. *extremus*; aboral view of holotype (nat. size).

PLECTASTER Sladen.

PLECTASTER DECANUS.

Echinaster decanus Müller & Troschel, Arch. f. Naturg., ix, 1843, p. 114.
Plectaster decanus Sladen, "Challenger" Rep., xxx, 1889, p. 535.

There are seven specimens of this typically Australian sea-star, but none are in very good condition, and only two have locality labels; these two are from Spencer and St. Vincent Gulfs. The size ranges from R = 50 mm. to R = 105 mm., while the breadth of the arm ranges from ·25 to ·33 R. The only one of the individuals which offers anything of special interest is one without locality, in which R = 93 mm. on two rays, while the other rays are less than 70 mm. Careful examination shows that one of these was broken (or bitten?) off, and has not regenerated, while the other two were evidently broken long ago, and have regenerated 33 mm. to 35 mm. (or more). The remarkable feature is that on the regenerated portion of these arms the typical network of ossicles is lacking, and is replaced by isolated elevations bearing spinelets or granules, much as in *Echinaster glomeratus*, clearly indicating the stock whence *Plectaster* has sprung. There is no corresponding modification on the oral surface.

FAMILY ASTERIIDAE.

CORONASTER Perrier.

CORONASTER sp.

A single small sea-star without locality has given me much difficulty, and it is only with great hesitation that I have decided to place it temporarily in *Coronaster*. Its distinctive features are so many and so striking that additional specimens will be readily recognized, and it is to be hoped that adult specimens will soon be found. It is probable that this specimen was taken by Dr. Verco in his dredging in Spencer or St. Vincent Gulf.

The present individual is obviously young. There are six rays, 12 mm. to 19 mm. long; madreporite large, close to margin of the very small disk; abactinal skeleton a very open mesh-work, as usual in *Coronaster,* with a carinal series of cruciform plates and a superomarginal series on each side; near base of ray there may be one or more dorsolateral plates. Each plate carries a single slender spine encircled with a wreath of pedicellariae, but on the smaller spines there are few pedicellariae in each wreath. There are some very small scattered pedicellariae on the disk, but there do not seem to be any on the rays. In spite of the large naked areas left between the skeletal plates, there are very few papulae, often only one to each area, occasionally as many as four.

The inferomarginal plates adjoin the adambulacral series; there is about one to each millimetre of the ray; the single spine is slender, acute, 1 mm. to 1·3 mm. long, not very much longer than the spines of the superomarginal series. Each inferomarginal spine bears a conspicuous wreath of pedicellariae. Adambulacral plates about three times as numerous as the inferomarginals, conspicuously and consistently diplacanthid, with long, slender, but not acute spines, the outer one a trifle longer, stouter, and blunter than the inner. There are no pedicellariae in the furrow or on the adambulacral spines.

In each actinal interradial area, just back of the oral plates, is a huge major pedicellaria, strongly unguiculate, similar to those of *C. volsellatus,* but with the "wrist" shorter and stouter. No other major pedicellariae are to be found. Pedicels biserial throughout.

The small number of rays and the scarcity of major pedicellariae make me hesitate to call this little sea-star *Coronaster,* but the form of the major pedicellariae, the abactinal skeleton, the marginal and adambulacral armature, all indicate a close relationship to that genus.

COSCINASTERIAS Verrill.

COSCINASTERIAS CALAMARIA.

Asterias calamaria Gray, Ann. Mag. Nat. Hist., (1) vi, 1840, p. 179.
Coscinasterias calamaria Perrier, "*Travailleur et Talisman*" Ech., 1894, p. 106.

There are fifty-one specimens of this common and characteristic Australasian species, ranging in size from R = 15 mm. to R = 225 mm., and in number of rays from seven to fourteen. Apparently eleven is the normal number, as thirty have that many rays, while only four have twelve, one has thirteen, and one fourteen; in this last the rays are evidently of three, and possibly four, different age-sets. Symmetry is rare, but one specimen with eleven rays has them approximately equal and about 120 mm. long. All sorts of combination of large and small rays occur, and it is difficult to see any indication of method or sequence in the addition of new rays.

Most of the specimens have no locality label, but several very fine ones are from Kangaroo Island, and there are also good ones from Althorpe Island, collected by Dr. Verco. A number of small ones are from Port Vincent, St. Vincent Gulf.

ALLOSTICHASTER Verrill.

ALLOSTICHASTER POLYPLAX.

Asterias calamaria Gray, Ann. Mag. Nat. Hist., (1) vi, 1840, p. 179.
Allostichaster polyplax Verrill, Harriman Alaska Exped.: Starfishes, 1914, p. 363.

This well-known species, common to both Australia and New Zealand, is represented by fifty-two specimens, ranging from R = 9 mm. to R = 35 mm. Of these, twenty-seven have eight rays, twenty-three have seven, and two have nine. More than half (twenty-eight) have the rays so unequal as to indicate the autotomy so characteristic of the species; usually there are two sets of rays, three or four large and three or four small, but in five cases one notes three sets, either one large, two smaller, and four quite small, or two, two, and three, or two, two, and four, or two, three, and three; in one case there are four sets, one, three, one, and two.

Most of the specimens have no locality label, but the three largest ones are from Coobowie, Yorke Peninsula, January 31, 1885, two are from Tumby Bay, two are from Guichen Bay (A. Zietz coll., March, 1889), one is from "between Trowbridge Light and Backstairs Passage," and most of the remainder are from either St. Vincent or Spencer Gulf, and are largely from the Verco collections. There are no indications as to habitat or as to the colours in life.

ALLOSTICHASTER REGULARIS [12] sp. nov.

R = 30 mm., r = 6 mm., br = 8·2 mm.; R = 5 r but not quite 4 br; form regularly pentamerously stellate, with equal (or subequal) rays, which are relatively high, and taper gradually to a blunt tip, where a large terminal plate is more or less concealed by granules or low spinelets; disk rather high but more or less flat, covered by a coarse network of skeletal plates, between which lie the rather large papular areas, but there are only one to three papulae in each one. Madreporite moderate, half-way between centre and margin, surrounded by a circle of a dozen or more somewhat capitate spinelets. All the dorsal plates carry such spinelets in considerable numbers and a few scattered, small pedicellariae.

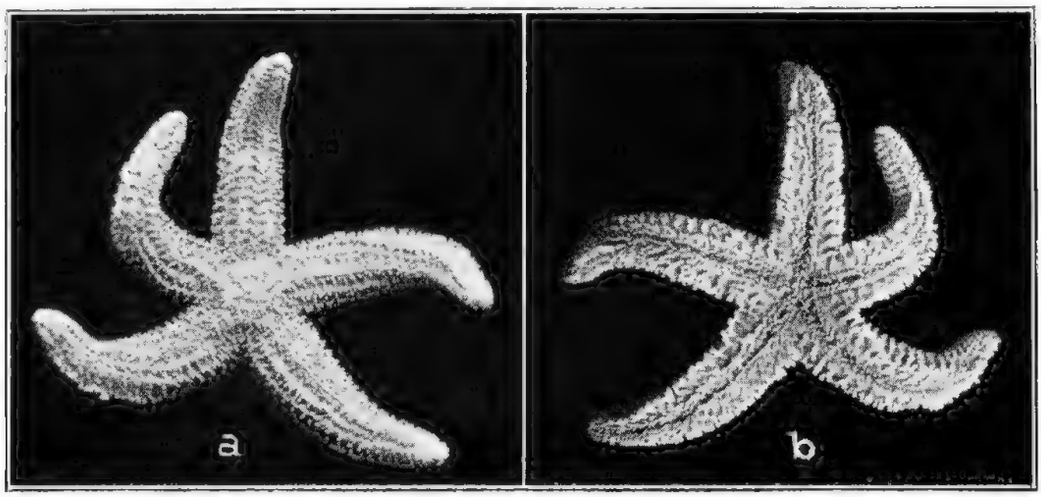

Fig. 115. *Allostichaster regularis;* a, aboral view; b, oral view of holotype (nat. size).

Superomarginals about twenty-two, higher than long, somewhat oblique, the surface more or less "beaded" at least dorsally, aborally; each plate carries about five small, somewhat capitate spinelets, of which one is rather by itself near the lower end of the plate, the others are on the adoral part of the plate, dorsally, and form an irregular oblique line; there are also eight to twelve pedicellariae on each plate. Carinal plates correspond in number with the superomarginals, and lie opposite their distal ends; each plate is wider than long, more or less triangular, at least on proximal half of ray, with an adoral angle; distally the lateral angles reach the superomarginals, but on the basal part of ray there is a single series of dorsolateral plates of rather considerable size; all the dorsal plates carry the small capitale spinelets and minute

(12) In reference to the constancy in number and appearance of rays as contrasted with *polyplax.*

pedicellariae; on the basal carinals are about ten spinelets and rather fewer pedicellariae, but distally there are only six or seven spinelets and four or five pedicellariae; each dorsolateral plate carries two to six spinelets and about half a dozen pedicellariae. Papular areas moderate with one to three papulae, usually only one.

Inferomarginals, corresponding in number and position with the superomarginals, form a very distinct angular margin to the ray, the oral surface being quite flat; each inferomarginal carries, except at very base of arm and close to tip, four spines, dorsal to which are half a dozen pedicellariae; these spines are flattened and widened at the end, the largest about a millimetre long and not quite half so wide at tip; on the basal half of the arm one of the spines is distinctly by itself on the oral surface of the plate, on its aboral margin, while the other three form an oblique comb, of which the adoral member is the most dorsal; distally as the plates become smaller the oral spine comes to lie in line with the others as the most distal and most oral member of the comb; occasionally it is quite wanting, especially on the distalmost plates; at the very base of the arm the adoral member of the comb is usually wanting. Actinolateral plates wanting, as are oral papulae, and pedicellariae are few and insignificant. Adambulacral plates regularly diplacanthid; the two spines are subequal, moderately stout, only a little flattened, but slightly widened at tip, scarcely a millimetre long. Oral plates with four spines each, of which the innermost are smallest and most wide-apart, so that the mouth angles appear to be actually widest at the tip and narrowest at the distal end; the two distal spines agree with adambulacral spines in size and form. Colour (in alcohol or dry), light yellow-brown ("museum colour").

Holotype: Reg. No. E. 437.

There are sixteen specimens of this species, of which the holotype is the largest, while one with R = 9 mm. is the smallest. In the little specimens the rays are relatively shorter and much stouter, there are no dorsolateral plates, fewer spinelets and pedicellariae, and only two or three marginal spines on the inferomarginal plates. In two specimens there are but four normal rays and one small one, but even in these cases it does not look as though autotomy occurs in this species (at any rate it must be infrequent), a very striking character which makes it easy to distinguish *A. regularis* from *A. polyplax*. In other respects the two species are much alike, but *A. polyplax* has smaller and more numerous dorsal spinelets, scarcely more than granules, and the papular areas are smaller and the dorsolateral plates more numerous.

All of the specimens of *A. regularis* at hand were taken in Spencer and St. Vincent Gulfs, but there are no exact locality labels.

SMILASTERIAS Sladen.

SMILASTERIAS IRREGULARIS ([13]) sp. nov.

Rays five, but two are broken off and one is missing; no two are even approximately equal; they measure 16 mm., 37 mm., 40 mm., and 49 mm.; r = 5 mm. and br = 6 mm. for the large arms, but only about 3 mm. for the small one; R = 9 to 10 r and about 8 br. Rays high at base, higher than wide, tapering slowly to a rather wide, blunt, slightly flattened tip. Dorsal surface of disk and rays covered with a closely reticulated skeleton, the longitudinal rows of which are not conspicuous basally, but distally the carinal series is fairly distinct; apparently there are two, and possibly three, rows of dorsolaterals on the basal part of the ray. All the plates carry a few widely-spaced, low, blunt (but not

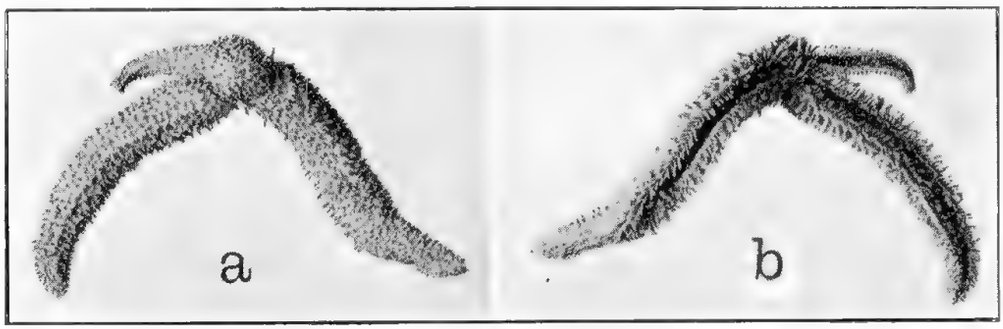

Fig. 116. *Smilasterias irregularis;* a, aboral view; b, oral view of holotype (nat. size).

at all capitate) spinelets and more numerous, but scattered, pedicellariae. Papular areas rather large, with two to six papulae in each.

Superomarginal plates, in the largest ray, about thirty, much wider (or rather higher) than long, clearly on the sides of the rays; each carries two or three small, blunt spines, well spaced, in an irregular vertical series, and a number of scattered small pedicellariae. Inferomarginal plates correspond in number and position with the superomarginals, but they are low, decidedly longer than high, and form a distinct, angular margin to ray; each one carries two flat, square-cut spines, side by side, or placed slightly obliquely; near base of ray these spines are 2 mm. long and ·60 mm. to ·70 mm. wide. No actinal intermediate plates and no oral papulae.

Adambulacral plates rather numerous, seven or eight to each trio of inferomarginals on basal part of ray, diplacanthid; at base of ray the two spines are subequal, nearly 2 mm. long, moderately stout, blunt, and slightly flattened, but the outer spine tends to be the larger, and may become distinctly longer and

([13]) In reference to the inequality of the rays.

stouter than the inner one distally, although, of course, both spines are much smaller there than proximally. Within the furrow are small, straight pedicellariae, one or none on inner face of each adambulacral plate; no other actinal pedicellariae, except one stout one in one interradial area. Oral plates each with three big, wide, flat marginal spines, and none on surface of plates; these oral marginal spines are as large as the inferomarginal spines, or nearly so. Tube-feet in four series at base of ray, but very soon passing into two normal series. Colour yellow-brown ("museum colour"), dry.

Holotype: Reg. No. E. 438.

This specimen is said to be from Spencer or St. Vincent Gulf, but there is no definite locality label, and there is no other specimen in the collection or in the Museum of Comparative Zoölogy at all like it. It seems to belong in *Smilasterias*, but is easily distinguished from the other species of that genus by the armature of the inferomarginal plates, for in them there are three or four inferomarginal spines set very obliquely on the plate, and in *S. scalprifera*, the genotype, moreover, the adambulacral plates are triplacanthid.

UNIOPHORA Gray.

The considerable series of specimens of this genus has been the source of great perplexity to me, and I am not at all positive that the following treatment is the best possible, but it represents my carefully considered judgment on the material available. The specimens of *Uniophora* in the Museum of Comparative Zoology are few and of little service in this connection; none of them are from South Australia. While I am recognizing no fewer than six species of *Uniophora* in the present collection, and have already described ([14]) a seventh from Western Australia, I am quite prepared to believe that extensive collecting and comparative study on the South Australian coast would show that some of these supposed species are merely local forms—or worse. But it seems better to describe and figure them, and thus bring to the front the question of their validity, than to obscure the situation by placing apparently distinct forms under a single name.

UNIOPHORA GRANIFERA.

Asterias granifera Lamarck, Anim. s. Vert., ii, 1816, p. 560.
Uniophora granifera Bell, Proc. Zool. Soc. London, 1881, p. 497.
Uniophora globifera Gray, Ann. Mag. Nat. Hist., vi, 1840, p. 288.

There are three specimens that I refer to this species with little hesitation. The largest, of which I am giving a figure, has R = 55 mm. and r = 15 mm. The other two are much smaller (R = 24 mm. and 29 mm.), and do not have nearly

([14]) H. L. Clark, Jour. Linn. Soc., Zool., xxxv, 1923, p. 244.

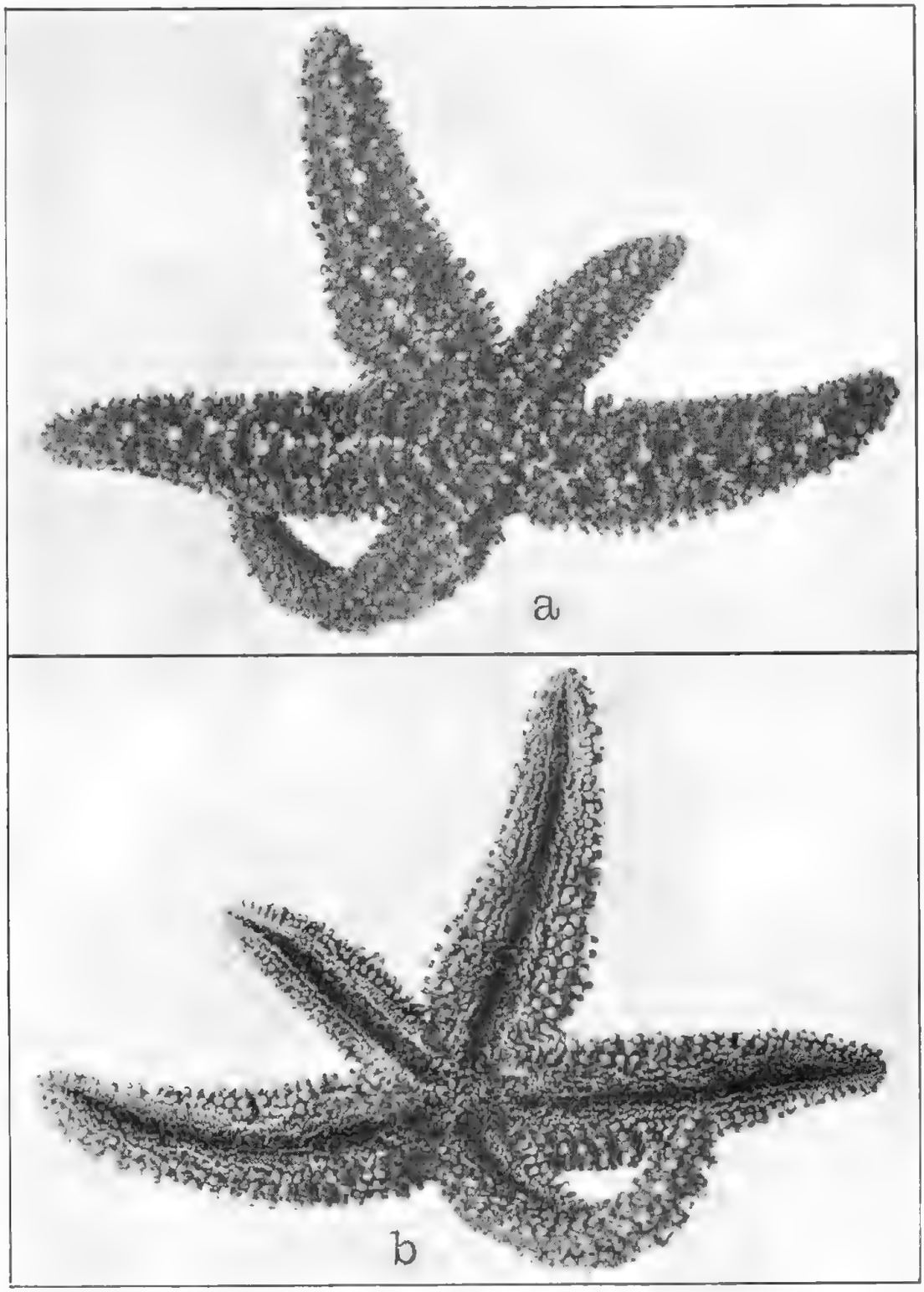

Fig. 117. *Uniophora granifera*; a, aboral view; b, oral view (nat. size).

so many of the characteristic globiferous spines on the dorsal surface. These three specimens have no locality label; they agree with each other, and differ from all the other *Uniophoras* in the collection in their deep reddish-brown colouration. I am following Fisher ([15]) in considering Gray's long-used name, a synonym of Lamarck's earlier but less familiar one.

UNIOPHORA GYMNONOTA ([16]) sp. nov.

R = 42 mm., r = 13 mm., br = 14 mm.; R = more than 3 r but just about 3 br; disk small, rays five, stout. Abactinal skeleton coarse, with large, irregular meshes; madreporite large, about half-way between margin and centre of disk. Carinal series of plates, conspicuous, closely united in a longitudinal series,

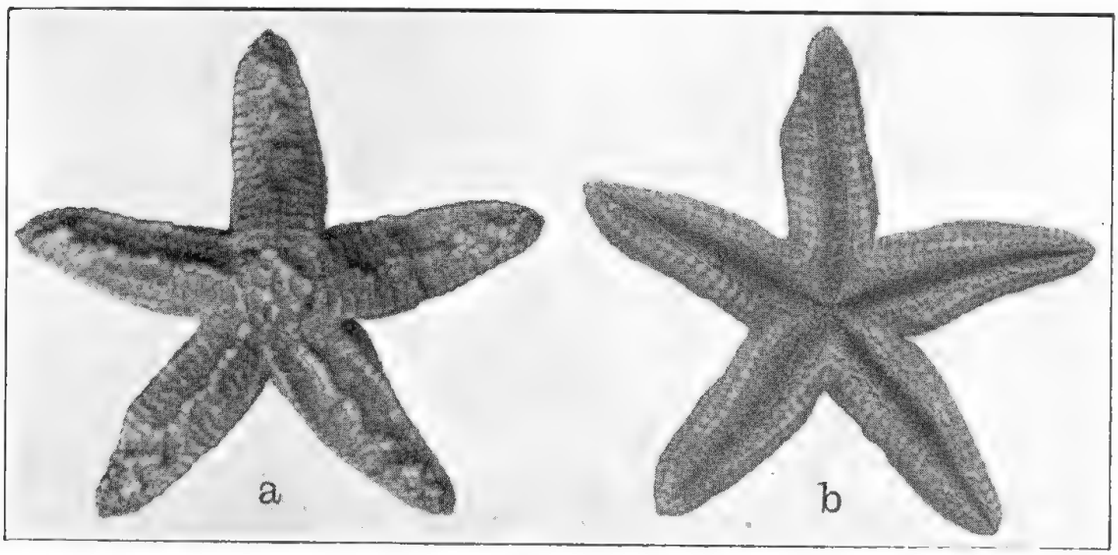

Fig. 118. *Uniophora gymnota*; a, aboral view; b, oral view of holotype (5/7 nat. size).

which distally becomes zigzag and irregular; superomarginals very similar but regular clear to tip of ray; "beading" on the superomarginals wanting proximally, well-marked only on the most distal plates; dorsolaterals in an irregular series, which is more or less clearly double proximally, and becomes obscure distally. Dorsal surface devoid of spines, except for a few small ones close to madreporite and at the tips of the rays, where two or three of the distalmost carinals carry single, low, thick spines. Small pedicellariae occur in abundance all over the dorsal surface, more especially on the large papular areas, and particularly near the tips of the rays.

([15]) Fisher, Ann. Mag. Nat. Hist. (9), xii, 1923, p. 597.

([16]) γυμνός=naked+νῶτον =the back, in reference to the absence of spines dorsally.

Lateral portion of ray nearly vertical, the superomarginals forming a conspicuous boundary to the rather flat dorsal surface. Inferomarginals about as large as superomarginals, tending to be oral in position, especially proximally, entirely free from spines. Actinal plates in three series at base of ray, but the innermost series is insignificant, consisting of but few, small plates; the second series is better developed, extending about half the length of the ray; the third series is clear enough, and extends nearly to the tip of ray. There are no spines on the inferomarginals or actinal plates, except that a few of the distal actinal plates carry single short, stout ones, but these are very irregular in size and position. Adambulacral armature regularly diplacanthid; the two spines on each plate are subequal, 2 mm. to 3 mm. long, stout, blunt, and nearly cylindrical. Within the furrow are rather numerous, small pedicellariae; these are also numerous on the sides of the ray, especially distally, but are infrequent orally. Oral plates narrow, square-cut at the inner end, each with two or three, rarely four, stout, blunt spines along the margin, which when directed inward overlap and completely cover the plates. Colour, dull yellowish or yellow-brown ("museum colour"), whether in alcohol or dry.

Holotype: Reg. No. E. 440.

There are half a dozen specimens of this form in sufficiently good condition to consider as type material. They range in size from R = 19 mm. to R = 75 mm. One of the small specimens has R = 25 mm., and the rays taper regularly to a blunt tip; there is a spine at centre of disk, and several carinal plates in each series carry similar but even larger spines; orally there is only one series of actinal plates, but most of them carry a single stout spine. The other small specimens, with R = 19 mm. to 32 mm., have the rays very stout and blunt, not at all tapering, the width at middle of ray being much more than a third of R. Some of the carinal plates carry conspicuous spines, and a large number of the actinal plates carry heavy spines. In the largest specimen, and also in the smallest, there are no dorsal spines, except for one or two small ones near tips of rays, while the actinal spines, although much more numerous than in the holotype, are scattered and irregular. It is clear that the deficiency in spines is more a matter of individual diversity than it is of age, but it certainly gives the form a very distinctive appearance. Alcoholic specimens show that in life the animal is covered with a thick fleshy skin, which more or less conceals plates and spines (except the adambulacrals and orals), and that the papulae are fairly numerous but not excessively so; the pedicellariae on the papular areas are numerous, and have fleshy bases, in which they are more or less sunken.

The holotype was dredged in "Backstairs Passage, near the Pages, about 25 fathoms; April, 1888; Field Naturalists' Excursion." Of the other specimens two are from Spencer or St. Vincent Gulf, while the remainder have no locality labels at all.

In addition to these type specimens there are sixteen individuals in such poor condition as to make their identification uncertain. They are dried flat, without care to prevent distortion. They range from R = 25 mm. to R = 100 mm., and have no locality label. They were in the same lot with eight specimens of *U. obesa (q.v.)*, but are recognizable by the lack of armature on the marginal plates. One of them has two rays (R = 50 mm. to 55 mm.), much smaller than the other three (r = 83 mm. to 88 mm.), suggesting autotomy, but it is more likely the fission was artificial and accidental.

UNIOPHORA MULTISPINA (17) sp. nov.

R = 82 mm., r = 17 mm., br = 22 mm. to 23 mm.; R = almost 5 r but hardly 4 br; disk rather large, not at all elevated; rays five, rather flat, tapering to a more or less blunt point. Skeletal plates arranged as usual in the genus, with large papular areas both on disk and rays. Madreporite conspicuous but

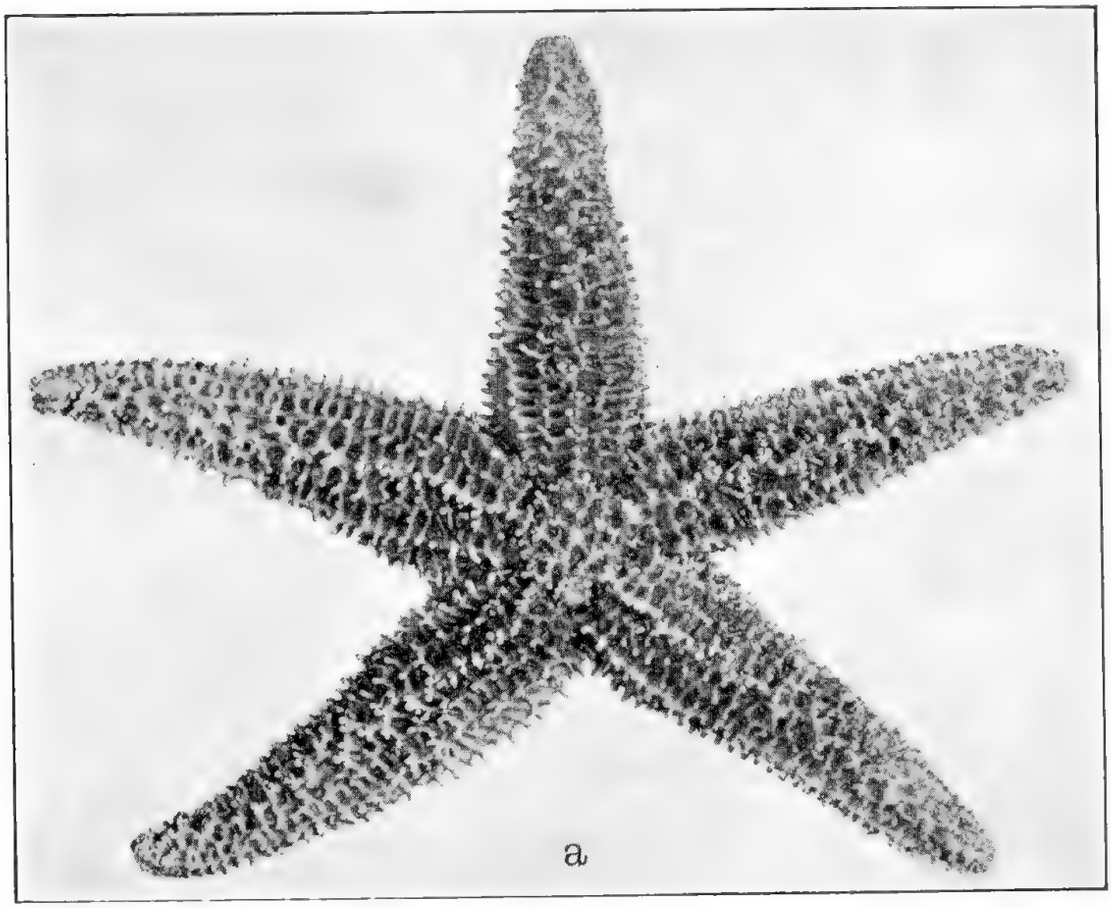

Fig. 119a. *Uniophora multispina*, aboral view of holotype (¾ nat. size).

(17) In reference to the numerous spines all over the animal.

moderate in size, half-way between centre and margin of disk, with a surrounding circle of about a dozen large, unequal spines. Carinal, dorsolateral, and superomarginal plates practically all with spines, the carinals often with two and occasionally with three or four; spines very unequal, usually cylindrical and blunt; on the carinals, often conspicuously capitate, but not to the extent

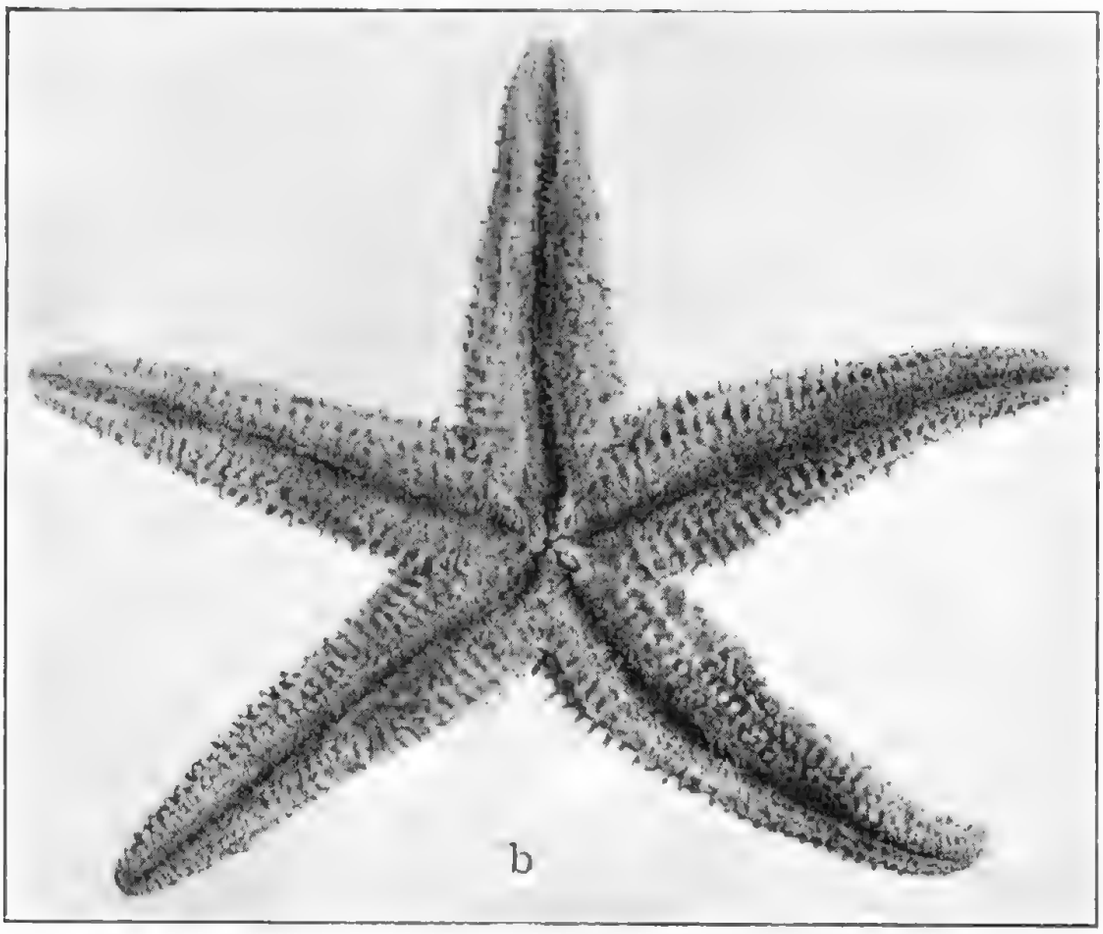

Fig. 119b. *Uniophora multispina*, oral view of holotype (¾ nat. size).

shown in *U. granifera;* superomarginal spines erect, not so capitate; "beading" on superomarginals very well-marked, even near base of ray. Many disk plates also with spines, but they are smaller than on the rays. Still smaller spines are found scattered here and there on the dorsal surface, as well as large numbers of pediccllariae.

Inferomarginal plates conspicuous, each with a prominent spine, which is short and somewhat capitate on the distal plates, but becomes longer, flattened, and widened at tip, proximally. Actinal plates in three series at base of ray, but the innermost series is short, the second reaches to about the middle of the

ray, and the third approximates the tip. Every plate carries a large spine, which is more or less flattened and widened at the tip; these spines may be 3 mm. long and over a millimetre wide at tip. Adambulacral armature diplacanthid, the inner spine on each plate is shorter, more slender, and more cylindrical than the outer, which is 2·5 mm. long, somewhat flattened, especially at tip, where it is also widened. No pedicellariae on any spines, but many small ones within the furrow and on the oral surface of rays, at least near tip. Oral plates narrow, compressed, each with three large, flattened spines, somewhat widened at tip, and one or two big, straight pedicellariae at the oral end. Colour (dry), very light yellowish or dirty white.

Holotype: Reg. No. E. 441.

There are five dry specimens of this form, all adult, and showing little diversity in size or form. R ranges from 52 mm. to 82 mm. The chief diversity shown is in the spines, which range from low and distinctly capitate to long, cylindrical, and pointed. The contrast between this species and *U. gymnonota* is most striking, not merely because of the spines, but because the skeletal plates in *U. multispina* are so much more delicate and numerous.

The holotype and the smallest specimen were taken in November, 1890, at "Henley Beach," near Adelaide, by C. B. Adcock; two specimens have no locality label; and one very good, large specimen is labelled, "Port River, Field Nat. Exc., Decr., 1901."

UNIOPHORA OBESA [18] sp. nov.

R = 62 mm., r = 16 mm. to 18 mm., br = 18 mm. to 20 mm. at base of ray, about 23 mm. near middle, and 12 mm., 10 mm. from tip; R = 3·5 r, but only 3 br; disk large, nearly flat, with large papular areas; rays five, more or less swollen, but flat or nearly so on the upper surface, with a very wide, blunt tip. Madreporite rather small, about half-way between centre and margin. Skeletal plates arranged as usual in the genus, about as heavy as *U. multispina*, but with larger papular areas; these latter are very conspicuous even on the oral surface of the rays. Carinal plates in a somewhat irregular series, which is quite zig-zag distally; many of these plates are very stout and high, in marked contrast to the neighbouring plates. Superomarginal series nearly as notable as the carinals, but hardly forming the margins of the ray, since the inferomarginals project more or less beyond them. Most of the dorsal plates carry small capitate spines, usually only one on each plate, but on the carinal plates they are distinctly larger, and there may be three or even four on a plate; the most conspicuously capitate have the "heads" 1·5 mm. in diameter; the smallest spines, and some

(18) *Obesus*=fat, in reference to the short, stout rays.

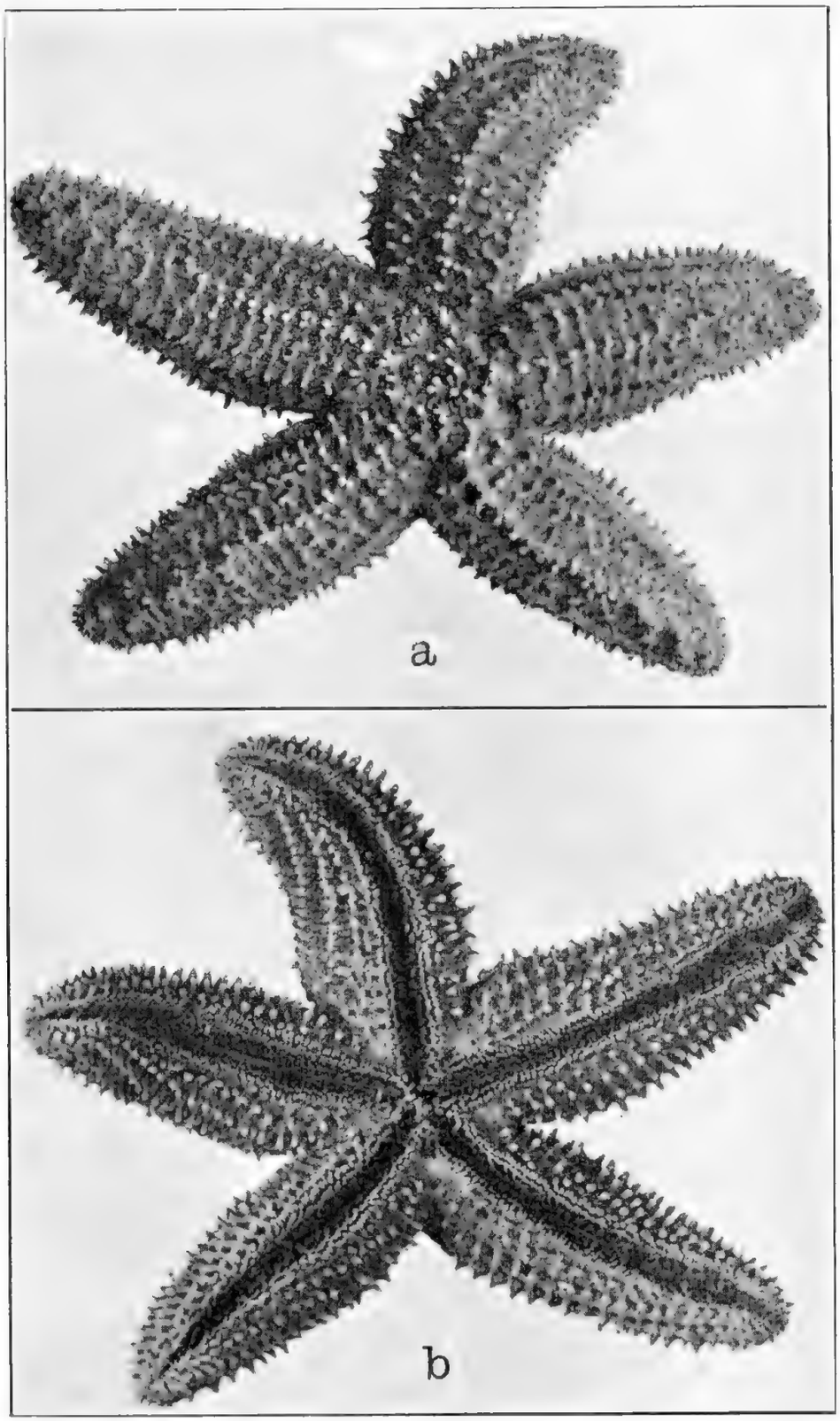

Fig. 120. *Uniophora obesa;* a, aboral view; b, oral view of holotype (nat. size).

of the larger ones, are not capitate. Beaded areas on superomarginals very small, sharply defined, and easily seen when plates are clean, but very hard to distinguish in the normal condition when covered with thick skin.

Inferomarginals very similar to superomarginals, and forming the true margin to the ray; each carries a spine about a millimetre long, cylindrical, blunt, scarcely capitate. Actinal plates very similar and similarly armed; more numerous than in other *Uniophoras*, even the innermost series extending beyond the middle of the ray; these innermost plates often carry two spines instead of one. Adambulacral armature diplacanthid, but there is an evident tendency for the inner spine to be smaller than the outer; often it is much smaller, and distally there are a good many plates from which it has disappeared; proximally the outer spine is more than 2 mm. long, flattened slightly at tip, and sometimes widened there. There are no pedicellariae on the adambulacral spines, but within the furrow small ones are plentiful, and they are very numerous all over the oral surface, sides, and back of rays, and on the disk. Oral plates as usual, with three pairs of stout spines, and a big, straight pedicellaria on each inner corner; the spines are 3 mm. long, flattened and more or less widened at tip. Colour (dry), brownish-yellow (typical "museum colour").

Holotype: Reg. No. E. 442.

There are two fine dry specimens from "Rocky Point, Eastern Cove, Kangaroo Island. October 2, 1901." The paratype is almost exactly like the holotype. There are also eight specimens without locality labels, in very poor condition, which I refer to *U. obesa* with some hesitation. They have R = 60 mm. to 100 mm., and all are dried quite flat, so that it is impossible to say whether the arms had the plump appearance of typical *U. obesa*. Oddly enough these specimens intergrade so with *U. gymnonota*, from the same lot and dried in the same way, that faith in the validity of the two species is sadly shaken. I am separating them in this particular lot, chiefly by the appearance of the marginal plates; those with unarmed marginals are, of course, *U. gymnonota*, while those with conspicuous spines on the marginals I am calling *U. obesa*. Probably in fresh or well-preserved material there will be little difficulty in distinguishing the two forms, typical specimens are so unlike. One of the poorly preserved specimens has six rays; it is the only non-pentamerous *Uniophora* I have seen.

UNIOPHORA SINUSOIDA.

Asterias sinusoïda Perrier, Arch. Zool. Exp., iv, 1875, p. 338.
Uniophora sinusoida Fisher, Ann. Mag. Nat. Hist., (9) xii, 1923, p. 597.

There are five examples which seem to represent this species, and as it has never been figured, I am giving figures of the largest specimen, which has

R = 75 mm. This specimen has no locality label, but the others were taken by Dr. Verco in Spencer or St. Vincent Gulf. The type locality is Hobart, Tasmania. The present specimens show very little diversity, but all have the distinctive characters of the species well developed. The zig-zag carinal series,

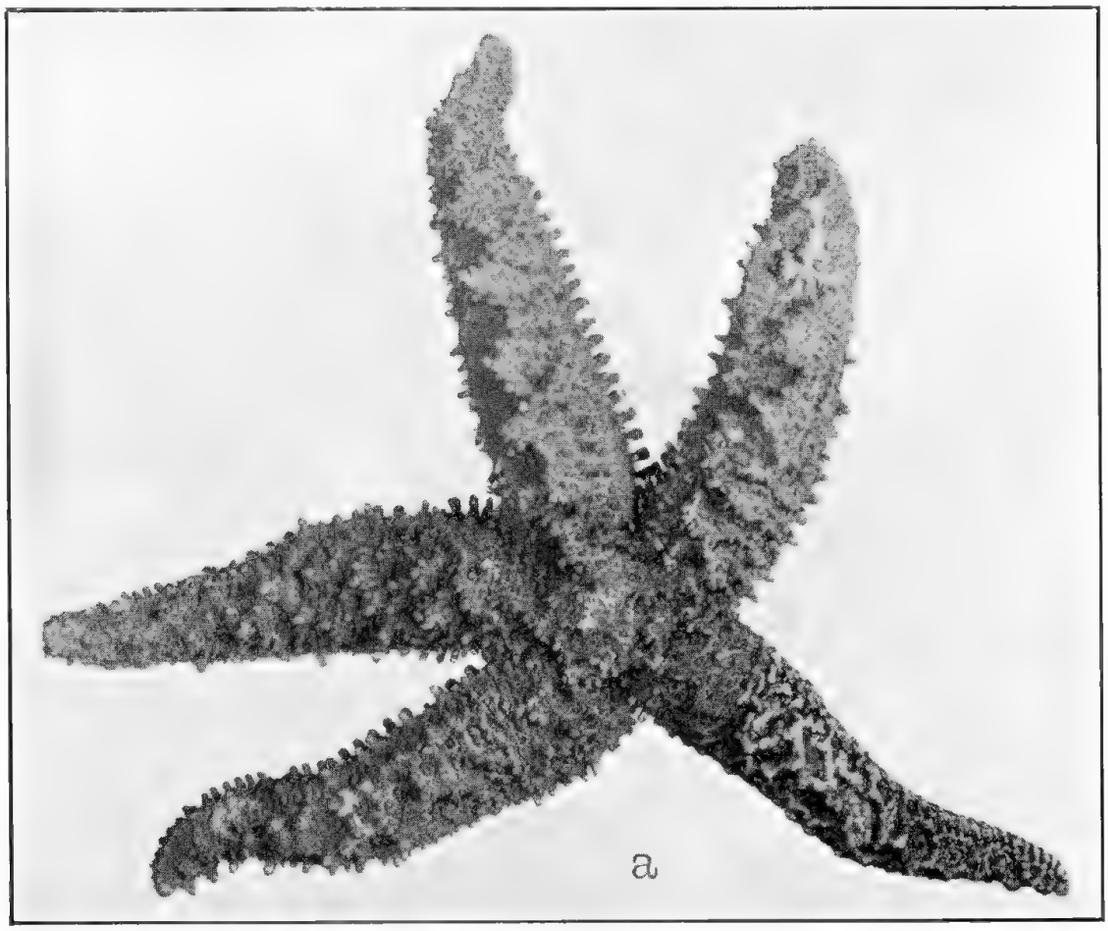

Fig. 121a. *Uniophora sinusoida*, aboral view (slightly reduced).

the marked contrast between the capitate dorsal spines and the flattened, terminally widened spines of the inferomarginal and actinal plates, and the small number of actinal plates, combine to give this species a very characteristic appearance. It may also be noted that there are distally often, if not usually, two spines on each inferomarginal, the distal one generally much smaller than the other. The smallest specimen has R = 30 mm., but is like the larger specimens in all essentials.

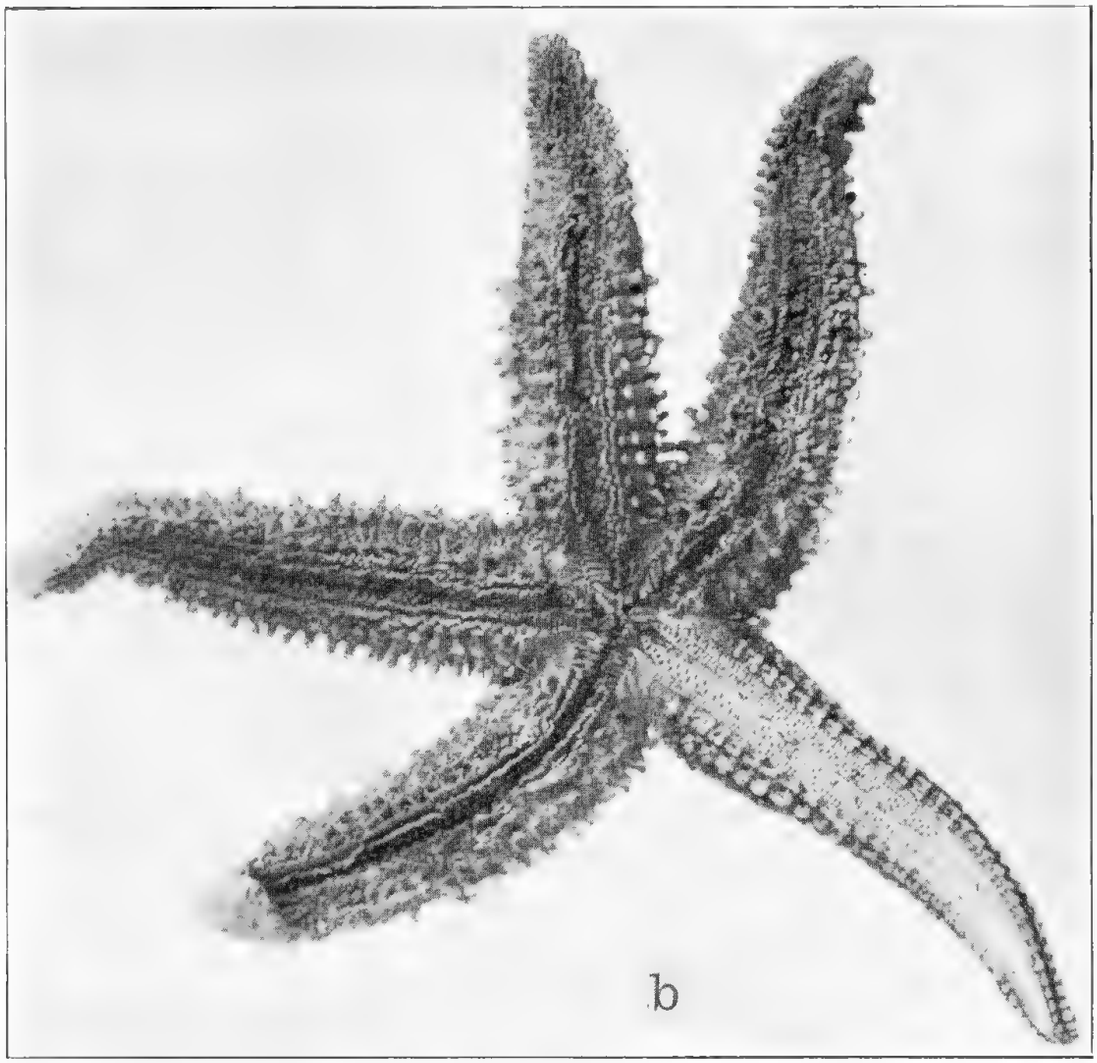

Fig. 121b. *Uniophora sinusoida*, oral view (slightly reduced).

UNIOPHORA UNISERIALIS [19] sp. nov.

R = 65 mm., r = 13 mm., br = 18 mm. at base, 20 mm. nearer middle, R = 5 r or 3·5 br. Rays five, broad, somewhat tapering, flattened above; disk moderate, rather flat; skeleton rather stout, especially the carinals; madreporite moderate, half-way from centre to margin, surrounded by about ten stout but pointed spines; similar but larger spines are scattered about on the disk. Carinal series with stout but conically pointed spines; not one on every plate, but about fifteen in all on each ray. Superomarginals similar to carinals, forming the margin of the ray, every other one more or less regularly with a spine

[19] *Uniserialis*=having a single series, in reference to the practical absence of dorsolateral spines.

similar to those of carinals; beaded areas conspicuous; dorsolaterals inconspicuous and practically without spines; there are, however, a few small spines here and there. Small pedicellariae abundant all over dorsal surface.

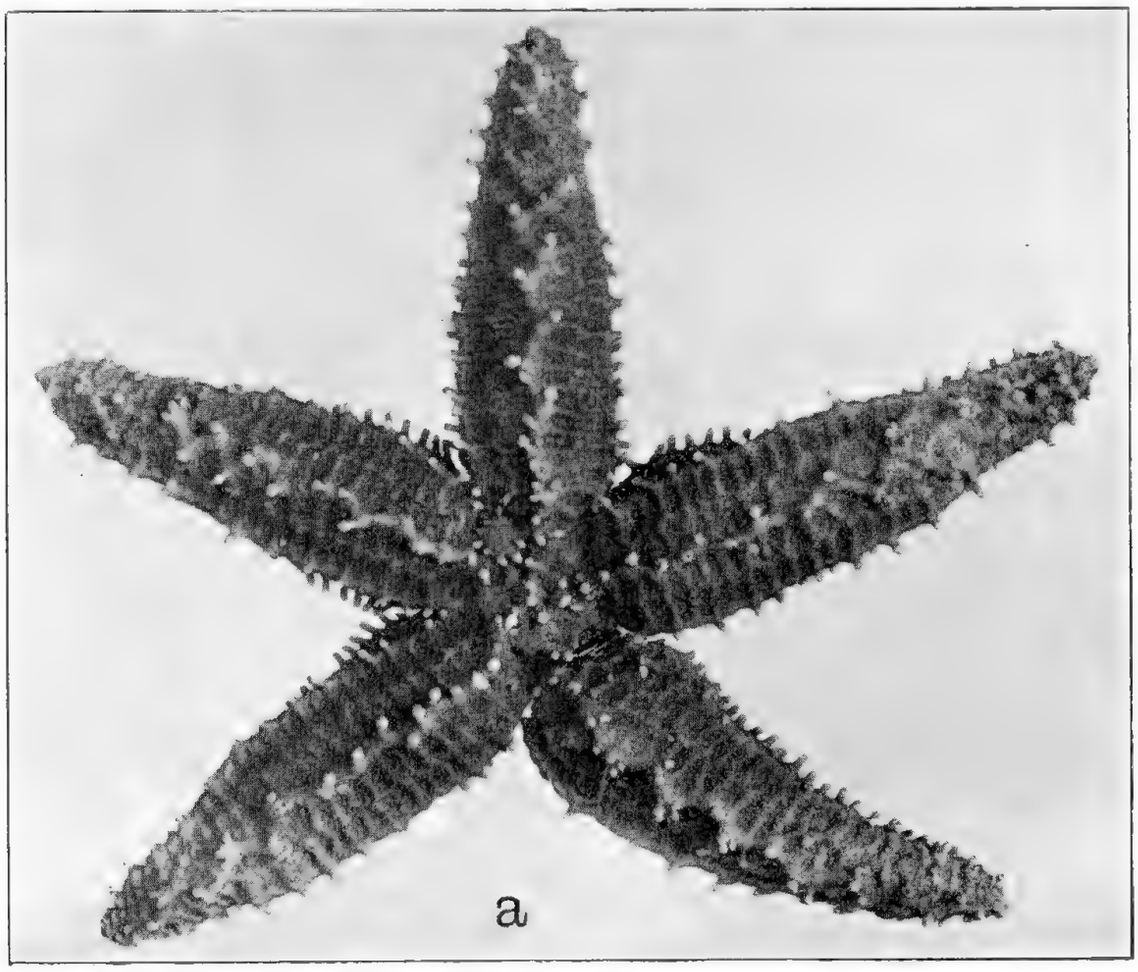

Fig. 122a. *Uniophora uniserialis*, aboral view of holotype (nat. size).

Inferomarginals smaller than superomarginals, and beyond the basal four or five each one (with few exceptions) carries a somewhat flattened spine, rounded at the tip. Actinal plates in only two series, and of these the one next the adambulacrals extends only a little more than a third of the arm-length; each plate carries a conspicuous spine, like those of the inferomarginals, but somewhat more flattened and usually wider at the tip. Adambulacral spines more or less cylindrical and bluntly pointed, but with a good many of the outer series enlarged, flattened, and widened at tip to a greater or less extent. Oral plates, as usual in the genus, but with only two spines on each one, and a big, straight pedicellaria on the inner corner. Numerous small pedicellariae in the

ambulacral furrow, and on the oral surface of the ray. Dry specimens "museum colour"; alcoholic material not essentially different.

Holotype: Reg. No. E. 444.

There are only three specimens to be referred to this species; the holotype described above from St. Vincent Gulf; a similar specimen without locality label; and a young individual, with R = 23 mm., from Dr. Verco's collections

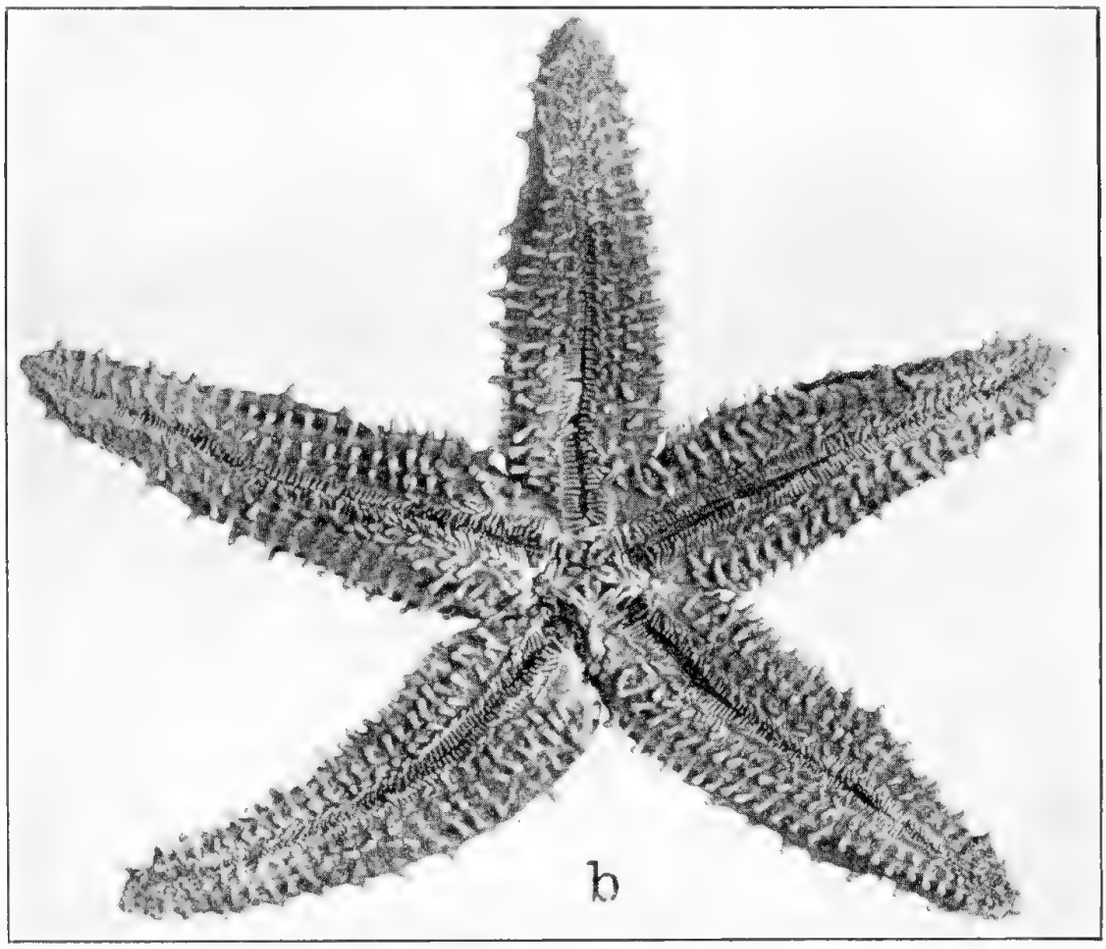

Fig. 122b. *Uniophora uniserialis*, oral view of holotype (nat. size).

in either St. Vincent or Spencer Gulf. The small individual has only one series of actinal plates. The form and distribution of the abactinal spines, the practical lack of dorsolateral spines, and the small number of actinal plates combine to give this species a distinctive appearance.

In view of the notable additions here made to the genus *Uniophora*, it is desirable to give a key to the nine species which are now known. Besides the six listed above, I believe Perrier's *Asterias nuda* and *A. fungifera* ([20]) belong

([20]) Perrier, Arch. Zool. Exp., iv, 1875, pp. 335 and 337.

in this genus, and my own Western Australian species, *U. dyscrita* ([21]) must be included. These various forms may be distinguished from each other as follows, but of course isolated specimens, especially if young or poorly preserved, may give trouble. Moreover, as remarked before, it is very probable that some, perhaps several, of the nine forms here called species are merely varieties or local races, and intermediate specimens will often occur.

KEY TO THE SPECIES OF *UNIOPHORA*.

a. Large, straight pedicellariae rare or wanting, except on inner end of oral plates.
- b. Dorsal spines conspicuously capitate, globose, or fungiform.
  - c. Dorsal, lateral, and actinal spines fungiform, the dorsal spines crowded .. .. .. *fungifera.*
  - cc. Spines more or less globose or capitate .. .. *granifera.*
- bb. Dorsal spines of diverse forms, often capitate, but not conspicuously so, and never fungiform.
  - d. Spines more or less numerous on dorsal surface, as well as on marginal and actinal plates.
    - e. Carinal series of plates and spines conspicuous and well defined.
      - f. Carinal series more or less zigzag at least distally; dorsolateral plates generally with spines.
        - g. Carinal series conspicuously zigzag, except near disk, its spines capitate, particularly the large ones; carinal and dorsolateral series forming a double series of large polygonal areas .. *sinusoïda.*
        - gg. Carinal series zigzag only distally, or if zigzag proximally its spines not capitate; no double series of large polygonal areas on dorsal surface of rays, but two series of smaller areas on each side of carinals.
          - h. Arms relatively short and stout; most dorsal spines small and capitate .. .. *obesa.*
          - hh. Arms longer, tapering; dorsal spines numerous, long, not capitate .. .. .. *multispina.*
      - ff. Carinal series nearly or quite straight, not more than one spine to a plate; dorsolateral spines practically wanting .. .. .. *uniserialis.*

(21) H. L. Clark, Journ. Linn. Soc., Zool., xxxv, 1923, p. 244.

ee. Carinal series inconspicuous and incomplete; spines of inferomarginal and actinal plates flattened, with tips chisel-shaped, or deeply channelled on upper surface, or even divided into two or three short branches .. *dyscrita.*

dd. Spines relatively few, wanting dorsally and on marginals except near tip of ray; more or less numerous, but often nearly wanting, on actinal plates .. .. .. *gymnonota.*

aa. Large, straight pedicellariae, numerous both in the ambulacral furrow and external to the adambulacral spines *nuda.*

Perrier gives "Port Lincoln (détroit de Torres)" as the locality for *Uniophora nuda*, of which I have never seen a specimen. No doubt Port Lincoln, South Australia, is the correct locality, for not only is there no Port Lincoln in the Torres Strait region, but no sea-star of the family Asteriidae occurs on the northern coast of Australia.

OPHIUROIDEA

There are 503 brittle-stars in the collection, representing forty-one species and one variety, but three specimens, representing the following three species, are non-Australian:

Gorgonocephalus caputmedusae (L.).
Gorgonocephalus lamarckii (M. & T.).
Ophioderma longicaudum (Retz).

No further reference will be made to these species.

Of the remaining thirty-nine forms, thirteen species and one variety are described as new, while one more species, an *Ophioscolex*, may prove to be new, but the only specimen in the collection is in such poor condition that no satisfactory distinctive characters can be made out. Three other species, *Astrochalcis tuberculosus*, *Ophiura oöplax*, and *Ophiozonella elevata*, are now recorded from Australia for the first time. One of the new species represents a very striking new genus, of the family Ophiolepididae, and shows aborally features reminding one of the West Indian genus *Ophiothyreus*, but is entirely different orally.

Of the thirty-nine forms, thirty-one are certainly from the southern coasts of South Australia, while eight are probably, in spite of labels to the contrary or entire lack of labels, from the waters of the Northern Territory; all but one of these are well-known tropical species, and there is no probability that any one of them occurs on the southern side of the continent.

Nearly a third of the 503 specimens represent the ubiquitous and perplexing

genus *Ophiothrix*, while more than half the remainder belong to *Ophiomyxa*, *Ophionereis*, *Pectinura*, or the new genus *Ophiocrossota*. Seven species, of which five, and possibly six (if the *Ophioscolex* already referred to is included) are new, are represented by only a single specimen each.

The occurrence of a new species of *Ophiocomina*, a genus hitherto monotypic, and known only from European and neighbouring seas, has enabled me to take up anew the question of the affinities of that genus, hitherto regarded in Europe as one of the Ophiocomidae. There can be no longer any doubt, I think, that it is not a representative of that family, but is almost certainly one of the Ophiacanthidae.

ORDER PHRYNOPHIURIDA

FAMILY OPHIOMYXIDAE.

OPHIOMYXA Müller & Troschel.

OPHIOMYXA AUSTRALIS.

Lütken, Add. ad Hist. Oph., pt. iii, 1869, p. 45.

There are forty-eight specimens of this well-known species, chiefly from St. Vincent and Spencer Gulfs. A few have more definite localities: Yorke Peninsula, Salt Creek, Coobowie, March 31, 1885, Mrs. E. Davie; Port Willunga; Port Vincent, and Tumby Bay. The smallest specimens are 10 mm. to 12 mm. across the disk, and the largest are 23 mm. to 25 mm. Apparently there is considerable diversity of colour in life, for even the alcoholic specimens are more or less unlike each other. The arms are often conspicuously banded, and occasionally the disk is adorned with large dark spots, 1·5 mm. to 2 mm. across. There are five arm-spines, or frequently only four in small specimens, and five, six, or rarely seven in the large ones.

OPHIOSCOLEX Müller & Troschel.

OPHIOSCOLEX sp. ?

There is an *Ophioscolex* with disk about 6 mm. across, and three arms about 20 mm. long, which resembles the European *O. glacialis* M. & T. so closely that I am unable to find a single character by which it can be distinguished. It is in such poor condition, however, that I am unwilling to identify it with a species whose occurrence in South Australian waters is so highly improbable. This specimen was collected by Dr. Verco in Spencer or St. Vincent Gulf.

FAMILY GORGONOCEPHALIDAE.

ASTROCONUS Döderlein.

ASTROCONUS AUSTRALIS.

Astrophyton australe Verrill, Bull. U.S. Nat. Mus., iii, 1876, p. 74.
Astroconus australis Döderlein, Jap. Euryalae, 1911, p. 36.

Fifteen specimens of this characteristic species are chiefly without locality labels; some are from St. Vincent and Spencer Gulfs, and there is one from Encounter Bay and one from Edithburg, gift of J. G. McDougall. The smallest specimen is only 8 mm. across the disk; there is a prominent knob at the inner end of each pair of radial shields, and two or three smaller ones near the outer margins; no knobs have yet developed on the arms. The largest specimen is 35 mm. across the disk, and the arms probably exceed 125 mm. There are relatively few knobs or tubercles on the radial "wedges" of the disk, but a good many on the basal portion of the arms. The colouration is very handsome, the depressed areas and lines on the disk and between the joints of the arms being dull purplish-brown in contrast with the pale yellowish-brown ground colour. One of the other specimens shows a tendency towards the same type of colour pattern, but the rest are uniformly whitish or light yellow-brown or red-brown.

There is the greatest diversity, quite apart from size, in the development of the tubercles, and also in the approximation of the radial ribs to each other, with the consequent development of radial "wedges." At one extreme are specimens with very few and small tubercles and narrow, widely separated radial ribs; at the other are individuals with numerous tubercles, often very large on the disk, and thick, approximated radial ribs, which so nearly monopolize the upper surface of the disk that the interradial areas are practically wanting, being reduced to mere furrows between the radial "wedges." Only the presence of many connecting forms convinces one that the two extremes really belong to a single species. While the extreme with radial "wedges" approaches *Conocladus,* the tubercles are very different from those of that genus, and the distinction between disk and arms is never wholly lost.

This Euryalid seems to find a congenial home on various sponges. Half a dozen of the present specimens are preserved in close association with the sponge upon which they were living, and apparently at least four species of sponges are represented among the six specimens.

ASTROBOA Döderlein.

ASTROBOA ERNAE.

Döderlein, Jap. Euryalae, 1911, p. 82.

It is interesting to find this Western Australian species occurring on the

coast of South Australia. While three of the six specimens in the present collections have no locality labels, the others are designated as from Kangaroo Island, Edithburg, and Victor Harbour. The Kangaroo Island specimen was presented in 1885 by Mr. Mollineux, that from Edithburg in 1897 by Mr. W. W. Cothell, and that from Victor Harbour, January 26, 1903, by Mr. George Jeffrey, harbour master. This Victor Harbour specimen is about 50 mm. across the disk, and the arms are about 200 mm. long. In colour the disk is reddish-brown, the radial ribs and the arms of a lighter greyish-brown. The other specimens are the usual "museum colour."

ASTROCHALCIS Koehler.

ASTROCHALCIS TUBERCULOSUS.

Koehler, Siboga Rep., Mon., xlv b, 1905, p. 130.

It is unfortunate that neither of the two specimens in the present collection has a locality label, for this is an East Indian species, and has not been recorded from Australia. While it is not impossible that these individuals were taken in Spencer or St. Vincent Gulf by Dr. Verco, it seems more likely that they are from the coast of the Northern Territory.

The two specimens are superficially quite unlike, but it is probable that their differences come within the range of diversity in the species. One specimen is light yellow-brown, with a disk 40 mm. across, and the upper surface of disk and arms out to the fourth or even the fifth fork bears numerous, big, hemispherical, smooth tubercles, 2 mm. to 4 mm. in diameter. The other individual is a much brighter brown in colour, and the tubercles are much less numerous and mostly smaller, particularly on the arms, where they are small and low, and extend little, if at all, beyond the second fork.

FAMILY OPHIACANTHIDAE.

OPHIACANTHA Müller & Troschel.

OPHIACANTHA BRACHYGNATHA [22] sp. nov.

Disk 6 mm. in diameter; arms 40 mm. to 45 mm. long. Disk covered with minute scales, nearly all of which bear a single stump or crochet, terminating in two to five (usually four or five) acute glassy thorns, more or less flaring, and only clearly visible under considerable magnification. Radial shields completely concealed. Upper arm-plates widely separated, bell-shaped, longer than even the distal width, with distal margin markedly convex.

(22) βραχύς=short+γνάθος=jaw, in reference to the unusually short, wide jaws.

Interbrachial areas below covered with plates a trifle larger than those of the disk; near the oral shields these plates are bare, but near the margin each carries a thorny stump, as on the upper surface of disk; in the holotype few of the plates carry the stumps, but in the paratype nearly all do so. Genital slits conspicuous, reaching nearly to margin. Oral shields moderate, wider than

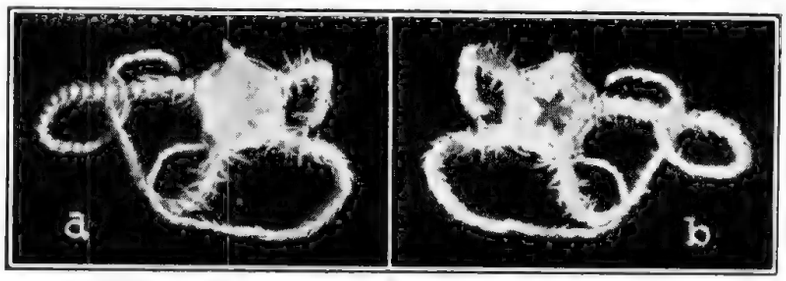

Fig. 123. *Ophiacantha brachygnatha;* a, aboral view; b, oral view of holotype (x 2).

long, with a strongly convex distal margin and a sharp proximal angle; the two inner sides are very slightly concave. Adoral plates large, curved, three times as long as wide, meeting widely within, but separated distally by the first under arm-plate; oral shields, adoral plates, and basal under arm-plates with a rather coarsely granular surface. Oral plates very small, each with three oral papillae and an unpaired one at the median line; the outer one on each side is flattened, wide, and rounded at tip; the others are about as wide as thick and are pointed; under the microscope they are finely thorny; the unpaired one is stoutest, the one next to the outermost is most slender. There are four flat, rounded teeth, uppermost widest; no tooth papillae.

First under arm-plate small, rounded pentagonal, outer portion much narrower than inner; second plate large, triangular, wider than long, with convex distal margin; succeeding plates decreasing in size and relative width, becoming more and more pentangular, with proximal angle less and less evident; all are widely separated from each other. Side arm-plates large, longer than high, especially distally, flaring at distal end, where each carries six or five slender, opaque, pointed spines, the uppermost longest, and equal to rather less than two arm-segments, the lower ones successively shorter; under high magnification the spines are very finely thorny, but they appear smooth to the unaided eye. Tentacle-scale small, rough, pointed. Colour (dry), nearly white.

Holotype: Reg. No. E. 453.

There are only two specimens of this new little brittle-star, and the paratype is only 4 mm. across the disk. They were taken in Spencer or St. Vincent Gulf by Dr. Verco. The disk covering, concealed radial shields, very short and wide jaws with spiniform oral papillae, and five or six opaque, pointed,

apparently smooth arm-spines make a combination of characters that will serve to distinguish this species from any other member of the genus, and especially from any other Australian brittle-star.

OPHIOCOMINA Koehler.

OPHIOCOMINA AUSTRALIS [23] sp. nov.

Text figs. 32, 33.

Disk 12 mm. in diameter; arms 50 mm. to 60 mm. long. Disk completely covered by a coat of very fine granules, one hundred to one hundred and fifty or more per sq. mm., which conceals the underlying covering of delicate scales, and even extends out a little on to the bases of the arms. Upper arm-plates fan-shaped, with distal margin more or less convex, lateral margins strongly diverging distally, proximal margin about one-third of distal; plates wider than long near base of arm, but becoming longer than wide distally, in contact throughout, except at very tip of arm.

Interbrachial areas below completely covered with fine granules, like those of disk. Oral shields somewhat diversified in form in different individuals. In large typical specimens they are wider than long, rhombic, or with distal angle somewhat truncate, making them pentagonal, all the angles, except the proximal, more or less considerably rounded; in other specimens, especially small ones, the length more nearly equals the breadth, and the shape is oval or more like a spear-head. Adoral plates long and narrow, typically meeting within, somewhat enlarged at outer end, where the first under arm-plate separates them. Oral plates large, each with five or sometimes six oral papillae, of which the innermost is the narrowest and most pointed, the outermost is widest, flattest, most rounded, and scale-like. At the tip of the jaw is an unpaired (rarely paired) papilla, like the innermost oral papillae, but smaller; above (below with the specimen upside down, of course) this is a pair (very rarely three) of similar but larger papillae, and above these come the narrow teeth, in the usual single column; rarely another pair of papillae, or possibly a pair of teeth, side by side, occur between the lowest tooth and the oral papillae.

Under arm-plates not peculiar; basally the width tends to exceed the length, but distally the reverse is true; distal margin and corners rounded; lateral margins usually more or less strongly concave; plates broadly in contact throughout. Side arm-plates rather small, but each carries, five, six, or near base of arm seven, long, delicate, blunt, hollow arm-spines, the lower ones equal to about two arm-segments, the upper ones nearly or quite equalling three; uppermost

(23) *Australis*=southern, in reference to the distribution, the other species of the genus being European.

spines often, if not always, slightly widened at tips; all the spines are more or less flattened, especially at the tip. Tentacle-scale single, oval, flat, rather large, its length about half that of an under arm-plate.

Colour of holotype nearly white, without any distinctive tint or markings; it is probably bleached. The largest paratype is similar, but has a rosy tinge; in two other specimens the disk is distinctly rosy or pinkish, and the arms are variegated with shades of grey, giving the impression of an indefinite banding; the upper arm-spines are lightly ringed or spotted with a dusky shade. In other cases the disk is light brown, usually somewhat mottled with a dull greenish shade, and the arms are pale brown, with more or less evident indications of banding. It is evident, therefore, that there is considerable diversity of colour in life.

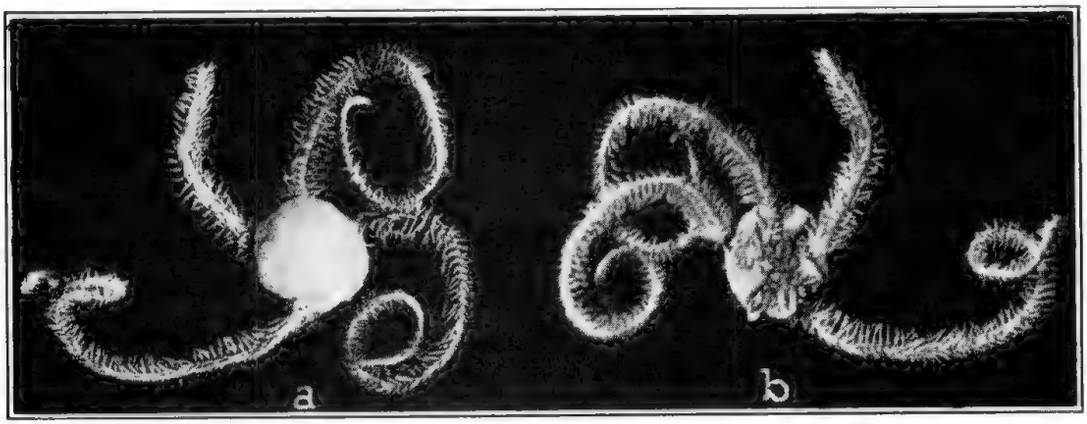

Fig. 124. *Ophiocomina australis;* a, aboral view; b, oral view of holotype (nat. size).

Holotype: Reg. No. E. 454.

The paratypes are all considerably smaller than the holotype, the largest being 10 mm. across the disk, with arms less than 40 mm. long; the others range from 6 mm. to 8 mm. across the disk. In most specimens the outline of the disk is circular, but in several it is distinctly pentagonal. Aside from this and the diversity of colour, the sixteen specimens are all very much alike. All were taken in Spencer or St. Vincent Gulf, two near Trowbridge Island, five between Trowbridge Lighthouse and Backstairs Passage, and three at Port Vincent. There is a superficial resemblance between this interesting species and young individuals of *Ophiocoma canaliculata*, but the latter has two tentacle-scales, a group of dental papillae at the tip of each jaw, and (in young individuals) only five arm-spines.

The occurrence of *Ophiocomina* in the waters of southern Australia is of

exceptional interest. The genus was established by Koehler in 1921 ([24]) for a European species long known as *Ophiocoma nigra*. In 1915 ([25]) I placed this ophiuran in *Ophiacantha*, as it is evident enough that it is not an *Ophiocoma;* I also re-established its earlier name of *O. sphaerulata*. In his fine report of 1922 Koehler ([26]) gives a more detailed account of his new genus, and points out its essential characters. In 1920 Mortensen ([27]) had already adopted Koehler's name in a vigorous attack on my position. He holds very strongly to the old name, *O. nigra*, and is very sure the genus is related to *Ophiocoma* rather than to *Ophiacantha*. This is not the place to discuss the proper name of the European species; I must, however, say, that I do not find Mortensen's argument convincing; as I have no doubt that Pennant refers to the species under discussion, I must use his name, since it is the earliest.

But the question of the position of the genus is much more important, and neither of my good friends has really given serious consideration to the most important points with reference to *Ophiocomina*. The first of these is the character of the arm-spines, heavy and solid in all the Ophiocomidae, but fragile and hollow in *Ophiocomina*, as in many *Ophiacanthidae;* in fact, arm-spines like those of *Ophiocomina* are not known among brittle-stars anywhere except in the Ophiacanthidae. Again, the mouth-parts of *Ophiocomina* are not at all like *Ophiocoma*, as both Mortensen and Koehler persist in asserting; there are no dental papillae, but only a few oral papillae at the tip of the jaw, just as happens in some ophiacanthids; moreover, as Mortensen himself has pointed out, the teeth of *Ophiocomina* are not broad and hyaline-tipped, as in *Ophiocoma,* but are narrow and rounded, without a peculiar tip, just as in most ophiacanthids. Finally, *Ophiocoma* and all its allies are strictly littoral, tropical forms, and the occurrence of a member of that family in cool water, at more or less considerable depths, on the north European coasts, would be most extraordinary; on the other hand the Ophiacanthidae have a world-wide distribution in waters of all depths and temperatures. It is perfectly incomprehensible to me how any zoologist, and particularly such experienced and competent students of echinoderms as my highly regarded European friends, could compare *Ophiocomina* with the Ophiocomidae on the one hand, and the Ophiacanthidae on the other, and not readily see the ophiacanthid affinity of the genus.

Comparison of the new species from Australia with the European species of *Ophiocomina* reveals but one important difference; in *O. australis* there is a single tentacle scale, while in *O. sphaerulata* there are two. The European

(24) Koehler, Faune de France, 1912, p. 93.
(25) H. L. Clark, Mem. M.C.Z., xxv, 1915, p. 205.
(26) Koehler, Bull. 100 U.S. Nat. Mus., v, 1922, p. 316.
(27) Mortensen, Vid. Med., lxxii, 1920, p. 50.

species is much the larger, but has only six arm-spines, while the Australian has seven at the base of the arm. The colour of *O. sphaerulata* seems to be in general much darker than that of *O. australis*, but light, and even bright, coloured forms are known. On the whole the resemblance between alcoholic specimens of the two species, when of approximately the same size, is quite striking, except for the tentacle-scales.

ORDER GNATHOPHIURIDA

FAMILY AMPHIURIDAE.

AMPHIURA Forbes.

AMPHIURA TRISACANTHA [28] sp. nov.

Disk 9 mm. in diameter; arms all missing save for the basal part of one, which is 20 mm. long and 1·5 mm. wide, not including the spines. Disk covered with coat of very fine overlapping scales, among which the primary plates can be distinguished only with difficulty; scales coarsest near radial shields, which are 2 mm. long but not ·5 mm. wide, separated from each other throughout but more widely so proximally, some of the intervening scales being remarkably elongated and narrow, and lying more or less parallel to radial shields. Upper arm-plates twice as broad as long, or broader, narrower proximally, fully in contact, outer margins rounded, but tending to form an angle at distal corners.

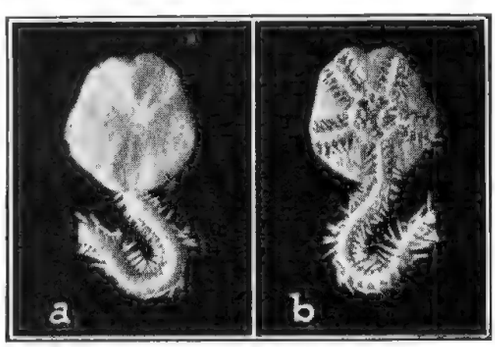

Fig. 125. *Amphiura trisacantha*; a, aboral view; b, oral view of holotype (x 2).

Interbrachial areas below with exceedingly numerous, fine, crowded scales. Oral shields more or less rhombic, length and breadth about equal, angles truncate or rounded; madreporite somewhat larger than others. Adoral plates small, narrow, not in contact at either end; radial end wider and rounded; inner end

(28) τρίς=thrice+ἄκανθα=spine, in reference to the number of arm spines.

pointed. Oral plates well developed, each with two oral papillae; inner block like as usual in *Amphiura*, outer large, oval, like the tentacle-scales, but twice as big. Second pair of oral tentacles very large.

Under arm-plates squarish or a trifle longer than wide, with rounded corners, and even distal margin, fully in contact. Side arm-plates small, but each carries three opaque, narrow arm-spines, tapering, but blunt and a little flattened; lowest longest, uppermost shortest, but there is no striking difference between them. At very base of arm there may be four or even five spines, but the upper ones are very small. Tentacle-scale single, moderate, flat, oval.

Holotype: Reg. No. E. 455.

The unique holotype of this species was taken by Dr. Verco in either Spencer or St. Vincent Gulf. It is very different from any other Australian *Amphiurid*, and the curious scaling of the disk, combined with the characters shown by the arm-plates and spines, gives the species a very characteristic facies, even in this large and widespread genus.

AMPHIODIA Verrill.

AMPHIODIA MESOPOMA.

H. L. Clark, Mem. M.C.Z., xxv, 1915, p. 247.

It is not surprising to find nine specimens of this species in the present collection, although the type came from Torres Strait, for the Museum of Comparative Zoölogy has a number of specimens taken at Westernport, Victoria, by the late Mr. J. Gabriel in 1914-15 ([29]). The South Australian specimens are all either from the Verco collections in Spencer and St. Vincent Gulfs, or they have no locality label. One has the interesting note with it: "Caught at night, trawling. Sept., 85 (blue light)." The smallest individual is 4 mm. across the disk; the largest is 7 mm., or equal to the holotype. Compared with that Torres Strait specimen, the disk scaling is somewhat less coarse, and the middle arm-spine less truncate, but the specimens from Westernport are almost exactly like the type, so I do not think there can be any doubt about the Torres Strait specimen and those from the southern coasts of Australia being actually identical. The arms in the holotype were broken, and I over estimated their length, I believe, for it is probable that they are usually six or seven times the disk diameter, hardly eight times, as stated in my original description. Some of the South Australian and Victorian specimens retain enough of their original colour to show that the arms are often, if not always, banded and marked more or less irregularly with yellow. The disk is grey.

([29]) H. L. Clark, Bull. M.C.Z., lxii, 1918, p. 287.

OPHIACTIS Lütken.

OPHIACTIS RESILIENS.

Lyman, Bull. M.C.Z., vi, 1879, p. 36.

This well-known Australian brittle-star is represented by seven specimens from the Vereo collections in Spencer and St. Vincent Gulfs. They are all adults, 6 mm. to 7 mm. across the disk. Their chief interest lies in the fact that in several (one in particular) the interbrachial areas below are more or less conspicuously naked, and are not covered with plates, as is usually the case in the species. This raises the question whether this particular feature is not more or less seasonal, associated with breeding. At any rate, too much stress must not be laid on it as a character distinguishing species from each other.

OPHIACTIS TRICOLOR [30] sp. nov.

Disk 7 mm. in diameter; arms about 25 mm. long. Disk covered with coarse, overlapping scales, but without spinelets or granules of any sort. Radial shields small, their width about one-half their length, which is itself less than one-half the disk radius; they are well separated proximally, but distally are in contact or only a little apart. Upper arm-plates more or less fan-shaped, with distal margin straight or nearly so, and distal corners rounded; they are broadly in contact on the basal part of the arm, but distally become less and less so, and at tip of arm are quite separate.

Interbrachial areas below covered with scales, much smaller than those of the disk; especially near the mouth they are very fine and crowded. Genital slits long and moderately conspicuous. Oral shields triangular or pentagonal with rounded angles, or more or less oval, elliptical, or circular, according to the degree to which the angles are rounded; madreporite usually conspicuous, about as long as wide; the other shields are commonly wider than long. Adoral plates not very large, more or less triangular, in contact radially, separating the first and second under arm-plates, not in contact in front of oral shield; distal angle separates oral shield from side arm-plate. Oral plates very small, each one completely overshadowed by the huge flat, fan-shaped, oral papilla, which is larger than the first under arm-plate. Teeth three or four in each series, thick and massive, lowest (outermost) smallest, uppermost (innermost) largest.

Under arm-plates squarish or slightly pentagonal with rounded angles, more or less in contact throughout, as wide as long (or wider) except distally (near tip of arm), and often the most proximal two or three; first plate very

(30) In reference to the red, white, and blue colouration.

small, separated from the second by the adoral plates. Side arm-plates rather large, each with three, or at very base of arm four, short, thick, bluntly pointed arm-spines; lowest smallest, others subequal, but uppermost often slightly largest. Tentacle-scale single, oval, moderately large, its length about one-third that of under arm-plate. Colour: disk, pale grey; arms, pinkish-white, with irregular, ill-defined bands of rosy-red and dull blue; blue is all on basal half of arm; red bands show on oral side of arms, and may be quite distinct there, especially distally.

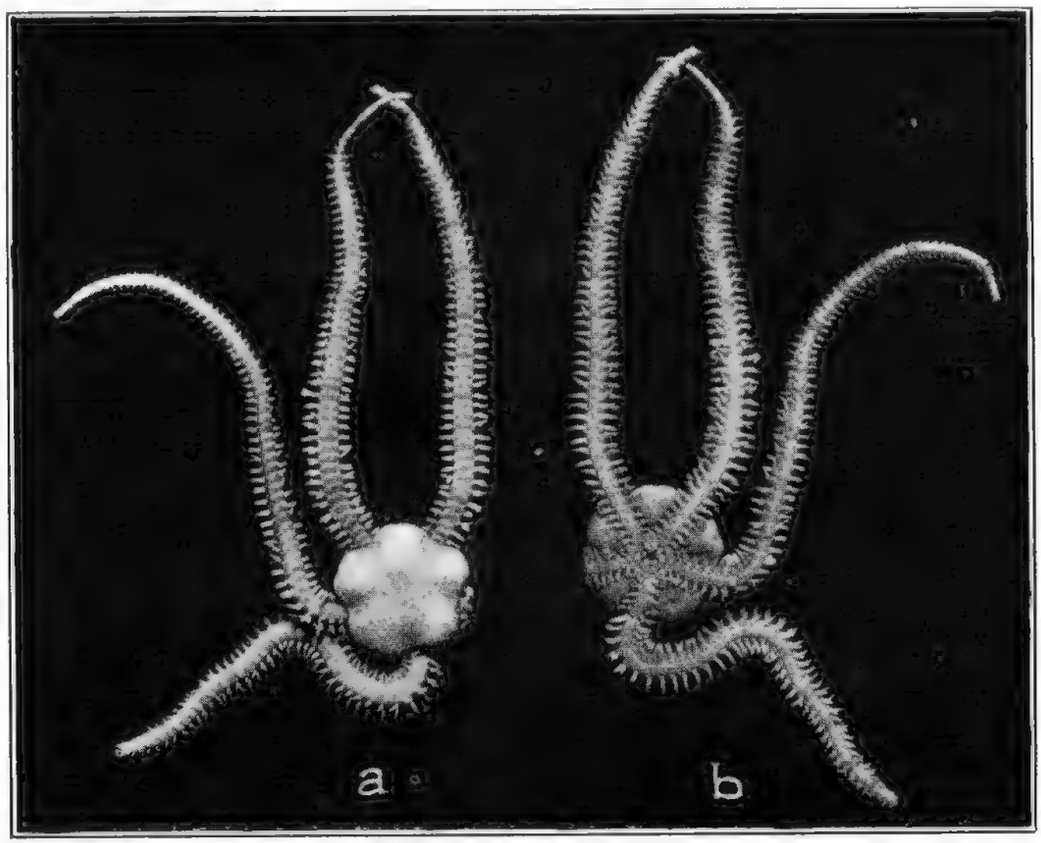

Fig. 126. *Ophiactis tricolor;* a, aboral view; b, oral view of holotype (x 2).

Holotype: Reg. No. E. 458.

There are eleven specimens from Dr. Verco's collections in St. Vincent and Spencer Gulfs. The smallest is 3 mm. across the disk, while the holotype is largest. There is little diversity in the structural features, but there is much in the colouration. The amphiurid-like disk, the dense scaling of the interbrachial areas, and the single, huge, oral papillae are very characteristic, and distinguish the specimens at a glance from *O. resiliens.* The relationship indeed is closer with the *O. plana—O. luteomaculata* group, but *O. tricolor* is very different from any of them.

One of the larger specimens has the upper arm-plates somewhat wider than in the holotype, but even when widest they are still "truncated fan-shaped" rather than elliptical. The specimen is further peculiar in its lack of distinctive colouration, the whole animal being dirty-yellowish, the arms showing only the faintest traces of banding, but it is quite likely that alcoholic bleaching is the explanation of this condition. The other specimens all show arm-banding more or less conspicuously, but the amount of blue on the basal parts of the arm is subject to great diversity. In most cases the blue has a greyish tinge, but now and then it is greenish, and in one specimen would be more naturally called dull green. Occasionally the red markings are tinged with purple, but usually they are very distinctly rosy. Usually the disk is unmarked, but in one specimen it is conspicuously spotted with dull blue. It is probable that the colours in life are much brighter than those exhibited by the present specimens.

FAMILY OPHIOTHRICHIDAE.

OPHIOTHRIX Müller & Troschel.

OPHIOTHRIX ALBOSTRIATA (31) sp. nov.

Disk 10 mm. in diameter; arms 50 mm. to 55 mm. long. Disk covered, except radial shields, with blunt, opaque, thick spinelets, only two to three times as long as thick, nearly smooth, and not at all thorny. Radial shields large, close together, but not in contact, nearly twice as long as wide, rounded triangular, perfectly bare and smooth. Upper arm-plates pentagonal at base of arm, and nearly as long as wide, but rapidly becoming oval or elliptical or rounded triangular, broadly in contact.

Interbrachial spaces below well covered with spinelets like those of the disk. Oral shields large, rounded pentagonal, about as long as wide. Adoral plates rather large, not meeting within, but lying one against each inner side of oral shield. Oral tentacles huge. Teeth and tooth-papillae not peculiar. First three basal under arm-plates elongated, narrow, markedly channelled longitudinally; beyond the third the plates become wider than long, with rounded corners, in full contact. Side arm-plates moderately large, each with nine or ten long arm-spines, the uppermost four or five longest and more or less subequal; all are slightly flattened, rough and transparent at tip; some are quite thorny, while others are nearly smooth. Tentacle-scales minute, spiniform, often wanting on the basal pores. Colour very light; disk yellowish-white, with radial shields bluish-white in definite contrast; upper surface of arm with a broad longitudinal

(31) *Albus*=white+*striatus*=streaked, in reference to the conspicuous line on the arms.

white stripe, faintly bounded with pale yellowish-brown, or distally with grey; this line is probably a conspicuous feature in life, but it may not be white then.

Holotype: Reg. No. E. 459.

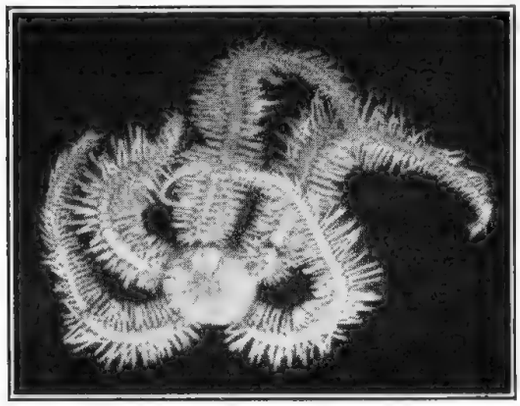

Fig 127. *Ophiothrix albostriata;* aboral view of holotype (nat. size).

A single specimen, said to be from the "Great Australian Bight," is the unique representative of this new species, which is well defined by the character of the disk covering and the curious colouration.

OPHIOTHRIX ARISTULATA.

Lyman, Bull. M.C.Z., vi, 1879, p. 50.

There are two fine specimens of this handsome brittle-star from Palmerston, Northern Territory, where they were taken in November, 1890. They are about 21 mm. across the disk, and the arms must have been about 125 mm. long. The colour, when dry, is almost pure white. These specimens are the first, I think, to be taken on the north Australian coast.

OPHIOTHRIX CAESPITOSA.

Lyman, Bull. M.C.Z., vi, 1879, p. 53.

There are sixty-five small specimens of *Ophiothrix* which I am referring to this species. They range from 2 mm. to 7 mm. in disk diameter, and show very great diversity in colour and in the disk covering, as well as in the form of the upper arm-plates. Several seem to be referable to the form to which I gave the name *acestra* ([32]) some years ago, but I am so uncertain now as to the validity of that form that I hesitate to use the name. The question as to whether there is more than one small Ophiothrix, having the disk covered with thorny stumps, with or without sharp spines among them, on the southern

([32]) H. L. Clark, Mem. Aust. Mus., iv, 1909, p. 544.

Australian coast can, I think, only be settled on the spot. Nearly all of the present specimens were taken by Dr. Verco in Spencer or St. Vincent Gulf (some are labelled "Trowbridge Island" and some "between Trowbridge Island Light and Backstairs Passage"), but a few have no locality label. The most conspicuous variety is a form, nearly uniform brown in colour, with a very large number of long, pointed, thorny spines on the disk. While like *O. acestra,* in some ways these individuals have the upper arm spines rather decidedly different, and moreover they seem to intergrade with typical *O. caespitosa,* with which they apparently occurred. The only way in which the actual relationship of these forms can be determined is by careful study of freshly collected material, the actual habitat and ecological conditions of which are known to the investigator.

OPHIOTHRIX HYMENACANTHA (33) sp. nov.

Disk 8 mm. in diameter, the flattened arms 45 mm. to 50 mm. long and nearly 2 mm. wide at base, apart from the spines. Disk perfectly bare; radial shields large, bare, occupying most of the upper surface; radial scales, between shields, elongated; other scales small but centrodorsal evident. Upper arm-plates

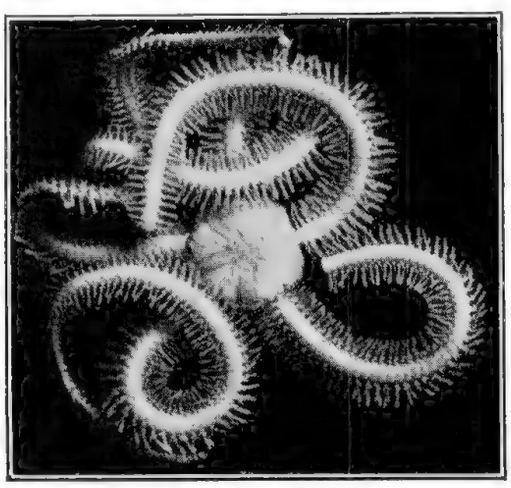

Fig. 128. *Ophiothrix hymenacantha;* aboral view of holotype (x 2).

elliptical, becoming rounded pentagonal distally, much wider than long, especially near base of arm, where width is more than twice the length, broadly in contact.

Interbrachial spaces below covered with minute, thorny spinelets. Oral shields wider than long, but in no way distinctive. Lower arm-plates

(33) ὑμήν=a membrane+ἄκανθα =a thorn or spine, in reference to the uniting of some arm-spines by a membrane.

wider than long, at least on proximal part of arm, with rounded corners, broadly in contact. Side arm-plates moderate, each with seven or eight spines; uppermost spine (at very base of arm, uppermost two) small, acicular; the next three as long as two and one-half arm-segments, the upper one pointed, the others with thickened, thorny tips; lowest three spines very small, the lowermost merely a serrate hook; on basal joints of arm the uppermost three or four spines in each series are united to each other by a definite transparent membrane like that in *Ophiopteron*. Tentacle-scales insignificant. Colour pale greyish-white; disk scales, arm-spines, mouth parts, etc., yellowish-white.

Holotype: Reg. No. E. 462.

There is a single dry specimen of this peculiar species, labelled "Great Australian Bight." Its generic position is open to question, for the disk is strikingly like *Ophiotrichoides*, while the basal arm-spines are distinctly suggestive of *Ophiopteron*. In the redefining of these two genera in the break-up of *Ophiothrix*, which is bound to come before long, it is possible that this isolated Australian species may be found to belong in one of them. It is certainly not a typical *Ophiothrix*.

OPHIOTHRIX LINEOCAERULEA (31) sp. nov.

Disk 8 mm. in diameter; arms 45 mm. to 50 mm. or more. Disk, except for radial shields, sparsely covered with blunt, opaque spinelets, which are not themselves thorny. Radial shields very large and bare, covering most of disk. Upper arm-plates broadly in contact, oblong or somewhat pentagonal, wider than long, with convex distal margin, and a shorter, straight or concave proximal one. Oral shields and adoral plates much as in *O. albostriata*, the adorals lying close to the inner margins of the large, rhombic shields. Under arm-plates broadly in contact, tending to be longer than wide, the basal one or two somewhat channelled. Side arm-plates rather large, each with seven (often only six) long, slender, more or less glassy arm-spines, which are rough at tip, though the upper ones are more or less pointed; the longest equal three segments of the arm or more.

Colour, dirty-whitish; inner (adradial) margin of each radial shield deep purplish-blue; distal margin with a more or less incomplete line of the same shade, and a triangular spot of the same colour is more or less in evidence on distal half of each shield, but this may be very faint; apparently continuous with the blue of inner margin of radial shields, two parallel lines of blue run out on dorsal side of each arm, extending to the tip; these are very distinct and well defined. Oral shields, adoral plates, and basal under arm-plates, blue;

(31) *Linea*=line+*caeruleus*=blue, in reference to the conspicuous markings on the arm.

beyond disk, most under arm-plates have a central area of whitish, so that the under side of the arm seems to have a double line of blue like the dorsal side; these lines, however, are not well separated, but tend to widen and run together on every joint.

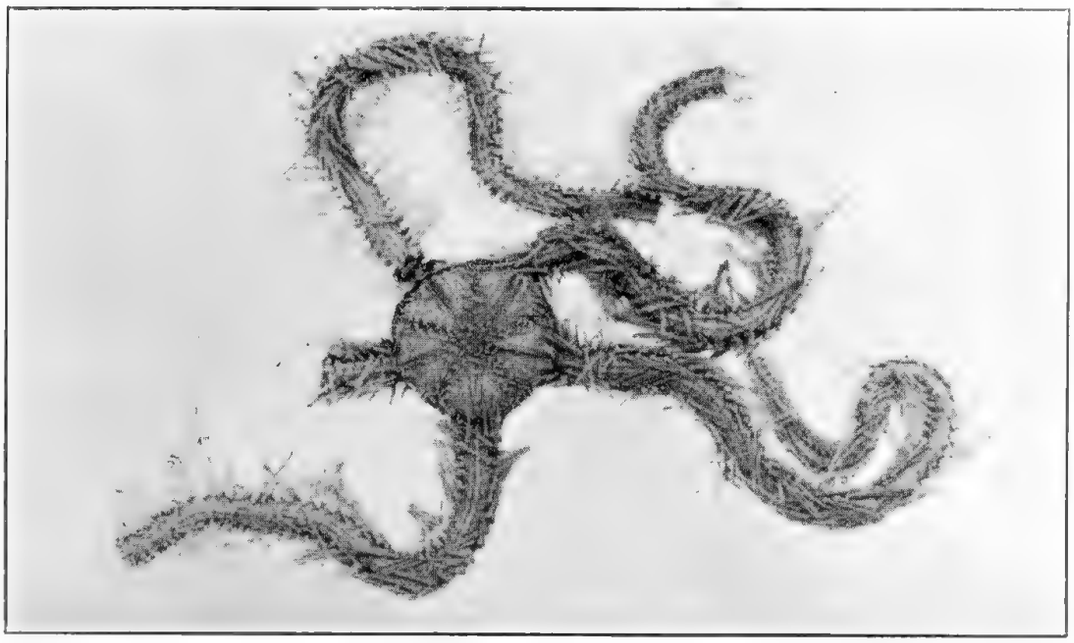

Fig. 129. *Ophiothrix lineocaerulea;* aboral view of holotype (x 2).

Holotype: Reg. No. E. 463.

There is only a single specimen of this handsome *Ophiothrix*, but the colouration is so very distinctive I have no doubt of the validity of the species. In this large and perplexing genus the colour pattern often gives the only reliable species character. Unfortunately there is no locality label with this unique specimen, and hence we cannot be certain that it is from South Australia, but it has the appearance of being from Dr. Verco's collections from Spencer or St. Vincent Gulf, and I feel very little doubt about its locality.

OPHIOTHRIX LONGIPEDA.

Ophiura longipeda Lamarck, Anim. s. Vert., ii, 1816, p. 544.
Ophiothrix longipeda Müller & Troschel, Syst. Ast., 1842, p. 113.

There are seven typical specimens of this well-known species, having disks 12 mm. to 14 mm. in diameter and arms 175 mm. long, more or less. Only one has a locality label, "Tumby Bay, South Australia, 28/x/1896." This example, except for being dry, is like the other six, and was probably of the same lot originally, but I very much doubt if any of them came from Tumby Bay.

Probably they are from the Northern Territory, where the species almost certainly occurs, as it is common everywhere on the north-eastern coasts of Australia. It is not known from south of Port Curtis, Queensland, and it is hard to believe that so large and conspicuous a brittle-star could have been overlooked if it occurs along the southern coasts of the continent.

OPHIOTHRIX MARTENSI AUSTRALIS.

H. L. Clark, Dept. Mar. Biol. Carn. Inst., x, 1921, p. 111.

There are nine specimens of this characteristic Australian subspecies, ranging from 6·5 mm. to 9 mm. across the disk. Aside from the fact that two or three of the alcoholic specimens are very markedly bleached, all are distinctly of the subspecies *australis*. One is labelled as from the Northern Territory, where one would expect the species to occur, five alcoholic specimens have no locality label, and three dry specimens are said to be from "Tumby Bay." It seems to me very unlikely that any form of *O. martensi* occurs on the southern coast of the Australian continent, hence I believe that all these specimens are from the Northern Territory.

OPHIOTHRIX SPONGICOLA.

Stimpson, Proc. Acad. Nat. Sci. Philadelphia, vii, 1855, p. 385.

There is a fine series of this typically Australian *Ophiothrix*, consisting of seventy-six specimens, ranging from 4 mm. to 19 mm. across the disk. They exhibit a considerable diversity of colour, and the growth changes are important. How much the colour differences are due to preservation it is hard to say. One specimen is very pale brown or dirty-whitish, with deep purple spots on the interbrachial spaces below, and a hint of a similar spot between the radial shields of each pair; otherwise there are no indications of colour, though there are faint traces of marks on the arms. The smallest specimens are very light-coloured, whitish or pale brown, with conspicuous blue or purple marks between the radial shields of each pair, and extending more or less on to the shields, and irregular markings of the same shade at regular intervals on the arms; the intervals are of three segments, which may be all light or only the middle one wholly light, the others more or less included in the coloured areas. In large specimens the blue may completely cover all the upper arm-plates, but usually indications of banding are distinct. The lighter areas of the arms are usually tinged with red, and may be quite red, the arms then being distinctly banded with red and deep purplish-blue. The shade of blue varies greatly from light greyish-blue to almost black. Stimpson's description says the colours are black and red, and it is probable that this is the impression given by many large specimens in life.

The specimen with the disk only 4 mm. across has no spinelets on the disk, except at the very margin, where a few occur; the interbrachial areas below lack scales as well as spinelets. The arms are only about 20 mm. long, or five times the disk diameter. A specimen about 6 mm. across the disk has arms about 10 mm. long, or nearly seven times the disk. Minute spinelets are beginning to appear on the disk scales. In the largest specimen the arms are over 160 mm. long, more than eight times the disk; the latter is rather thickly covered with thorny spinelets, which are even crowded in between the radial shields of a pair; the radial shields themselves are, however, quite bare. As a rule the disk is well covered with low, blunt spinelets, but it is not uncommon to find specimens in which these are wanting, except near the interbrachial margins. In spite of all this diversity in spinulation and colour, the species is easily recognized, at least among the Australian members of the genus.

These specimens are chiefly from the Verco collections, largely from Spencer and St. Vincent Gulfs. A few are from near Trowbridge Island, or between Backstairs Passage and Trowbridge Lighthouse. There are two from Tumby Bay, and several have no locality label. The species is known to range from the Abrolhos Islands on the west coast of Australia, along the whole southern coast, to Broken Bay on the eastern coast of New South Wales.

ORDER CHILOPHIURIDA

FAMILY OPHIOCHITONIDAE.

OPHIONEREIS Lütken.

OPHIONEREIS SCHAYERI.

Ophiolepis schayeri Müller & Troschel, Arch. Naturg. x, 1844, p. 182.
Ophionereis schayeri Lütken, Add. ad Hist. Oph., pt. 2, 1859, p. 110.

There is a fine series of twenty-nine specimens of this well-known species, ranging from 7 mm. to 21 mm. across the disk. The diversity in colour is considerable, but is probably in large part artificial. Thus the lightest individual is cream-colour, with faint indications of any markings, even the bands on the arms being indistinct, but it is quite probable that the specimen has been bleached in preservation. Again, the darkest specimen is a rich red-brown, with the usual markings evident but dull; this individual has apparently at some time been in a rusty container, though it is not impossible that the colour is natural. Normally, dry specimens are pale and dark grey of various shades, while alcoholic specimens have a very evident brownish-yellow appearance.

One of the present series, a young specimen 7 mm. across the disk, is labelled "*Ophionereis fasciata* Hutton." There is no locality given, but the label is in every way similar to the labels on certain New Zealand specimens in the collection, and I have little doubt that this specimen came from New Zealand. Mortensen ([35]) is very sure that the New Zealand and Australian forms represent two different species, and he retains the name *O. fasciata* for the New Zealand form. But the differences which he emphasizes are by no means as constant as could be desired, and I am very much in doubt whether the New Zealand *Ophionereis* is really so recognizable as Mortensen thinks. While I have a considerable series of Australian specimens at hand, I have only a few from New Zealand, so I am not ready to reach a final conclusion. Mortensen holds that the Juan Fernandez *Ophionereis* is also different from that occurring in New Zealand. There is but one Juan Fernandez specimen at hand, and it is only half-grown, but it does not incline me towards Mortensen's view. One point to which my esteemed Danish colleague refers demands a careful investigation, namely, the size of the eggs. It is an open question in my mind whether this has the significance which he attributes to it, and I very much doubt its constancy and importance. Certainly the very close relationship of the forms of *Ophionereis* occurring in Australian seas, at New Zealand, and at Juan Fernandez, is beyond question. One striking feature which they have in common, evident even in young specimens, is the occurrence of four arm-spines on the basal arm-segments. This is very constant, and enables one to separate them from the Indo-Pacific species *O. porrecta* very readily. Whether we call them *O. schayeri*, or consider the New Zealand and Juan Fernandez forms subspecies, or even full-fledged species, seems to me relatively unimportant, but, nevertheless, the correct solution of the problem will be interesting. The *Ophionereis* from the Abrolhos Islands, W.A., which I published as *porrecta* ([36]), are undoubtedly small specimens of *schayeri*, as a re-examination shows. Hence this southern form is one of the few typically Australian echinoderms which have reached the Albrohos Islands.

Most of the present specimens were taken in either Spencer or St. Vincent Gulf, but two are from Tumby Bay, and seven very fine ones are from Port Willunga, Zietz collection. There are two specimens labelled "N. Australian coast" which resemble these Port Willunga specimens so closely I have little doubt they are from the same place, if not actually the same lot. There is also a small specimen labelled "Northern Territory" which is undoubtedly from the southern coast of Australia.

([35]) Mortensen, Vid. Med., lxxvii, 1924, p. 164.

([36]) H. L. Clark, Jour. Linn. Soc., Zool., xxxv, 1923, p. 247.

OPHIONEREIS SEMONI.

Ophiotriton semoni Döderlein, Jena. Denkschr., viii, 1896, p. 288.
Ophionereis semoni Koehler, Siboga Rep., Mon., xlv b, 1905, p. 54.

It is a matter of great interest to find this little brittle-star common on the coast of South Australia, for it was hitherto recorded in Australia only from the Torres Strait region and Green Island, off Cairns, Queensland. I have already discussed ([37]) the relationship of this species to *O. dubia*, but I may add here my more recent conclusion that the genus *Ophiocrasis* ([38]) is not worth maintaining, as *O. semoni* is such a complete connecting link between it and *Ophionereis;* but a comparison of *semoni* with the two Japanese species of *Ophiocrasis* shows that both are quite distinct from *O. semoni*, which is readily distinguished from all its allies by the skin-covered oral surface, as already described by me ([37]).

The present series of twenty-two specimens of *semoni*, with disks 2·5 mm. to 7·5 mm. across, were all taken by Dr. Verco in St. Vincent and Spencer Gulfs. As they are in five different lots, there does not seem to be any room for doubt about the general locality. Compared with Queensland specimens, the only difference is in the more generally green colouration of those from the north which are distinctly green (more or less of an olive tint) and white, while the southern individuals are brown and white, though the markings on the arms are, in young specimens at least, distinctly greenish. The disk is brown with a white reticulation (curved lines), or white with a brown reticulation of the same character, or dark brown reticulated with a light shade. When dry all the tints become greyish, and there is no indication of green. One striking feature of the colouration, evident in both northern and southern specimens, is found in the white oral shields, surrounded by a greenish or brownish circle. If more abundant material shows that the northern specimens are typically green and white, and the southern brown and white, with a very definite constancy, the latter might well be designated by a subspecific name.

FAMILY OPHIOCOMIDAE.

OPHIOCOMA Agassiz.

OPHIOCOMA CANALICULATA.

Lütken, Add. ad Hist. Oph., pt. 3, 1869, pp. 46, 99.

A good series of fourteen specimens of this rare species shows that it is not infrequent on the coast of South Australia. There are two specimens

(37) H. L. Clark, Dept. Mar. Biol., Carn. Inst., x, 1921, p. 118.
(38) H. L. Clark, Bull. U.S. Nat. Mus., lxxv, 1911, p. 175.

without locality labels and one specimen from Edithburg; all the others are from Spencer or St. Vincent Gulf, and for most of them we have to thank Dr. Verco. The smallest individual is little more than 6 mm. across the disk, and the arms are only about 22 mm.; the colour is dark grey with a slight purplish tinge; on the upper side of the arms are a few, irregular, widely scattered white marks; the under side of the arms is grey, with a broad, median white band, and the arm-spines are pale grey; for the most part there are but four arm-spines, but basally there are five, and on one or two joints there are six. Another specimen 7 mm. across the disk, with arms 30 mm. long, also has four and five arm-spines; it is pale brown in colour, with distinct but faint indications of dusky bands on the arms; the under side of the arms shows the broad median white band of the darker specimen. Both these young individuals have the granulation of the disk much finer and denser than in adults; there are at least 80 to 100 granules per sq. mm., but the interbrachial areas below are as bare and free from granules as in the adults.

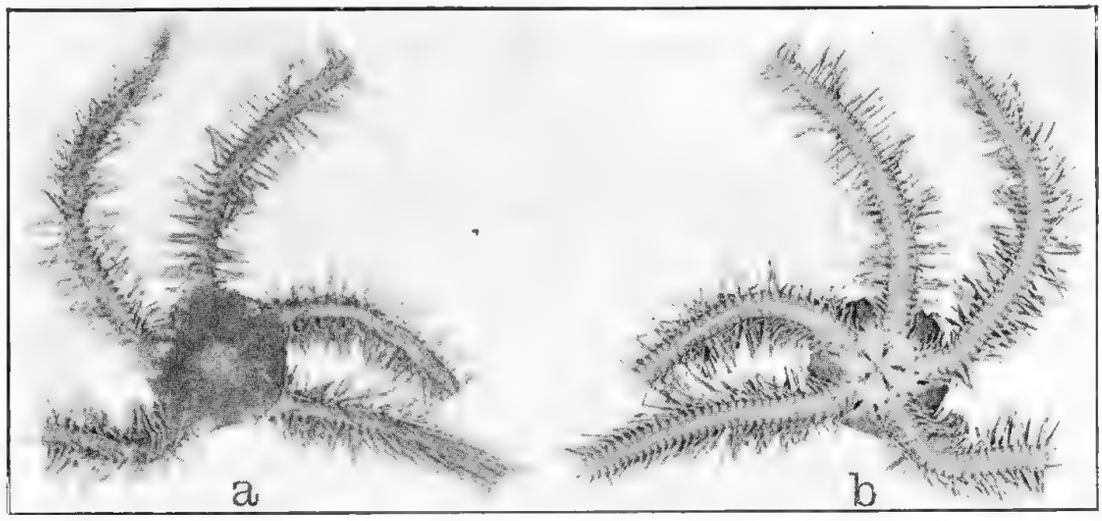

Fig. 130. *Ophiocoma canaliculata;* a, aboral view; b, oral view (nat. size).

The largest specimen is 21 mm. across the disk, but all the arms are broken; the longest is 52 mm., and was probably well over 60 mm., but it was certainly not over 70 mm.; the colour is a light blackish-brown, with the arm-spines a much lighter yellow-brown; the under side of the arms shows the longitudinal white band on the first two or three segments distinctly, but further out it is much less evident; the specimen is probably somewhat bleached. The other large specimens are all darker, the colour ranging from brown to black, the arm-spines lighter than the disk, especially at their tips; in some cases they are reddish, and in one specimen very conspicuously so on distal part of arms. The

longitudinal white band on the under side of the arms is a characteristic feature, usually conspicuous at least at the base of the arms; in the blackest specimen it is well marked on the first five or six segments, and then fades away and becomes very indistinct. In no specimen is there any indication of banding on the arm-spines.

OPHIOCOMA CANALICULATA var. PULCHRA (39) var. nov.

There are half a dozen *Ophiocomas* which agree well with *O. canaliculata* in everything but colour, and their striking appearance warrants designating them by a varietal name. As they probably intergrade with the typical form, and seem to occur with it, it is not likely they represent a different species. The two constantly characteristic features are found on the arm-spines and the

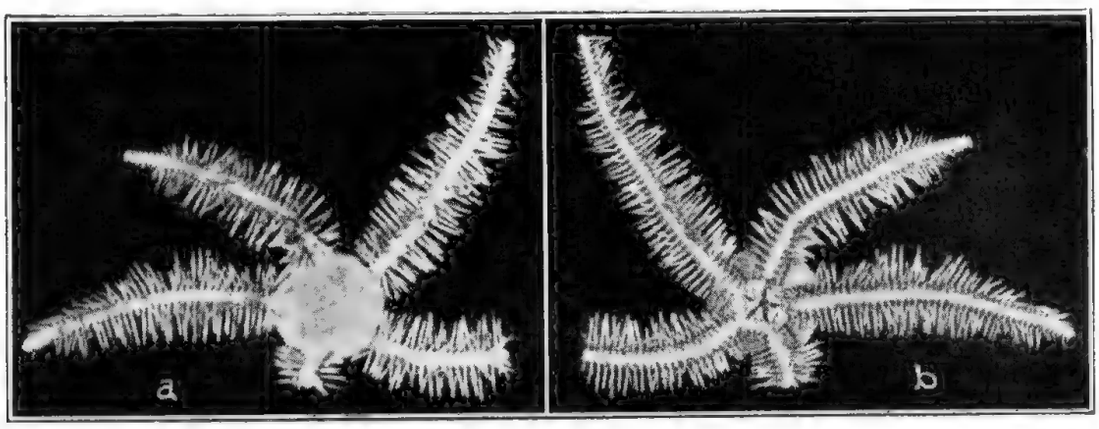

Fig 131. *Ophiocoma canaliculata* var. *pulchra;* a, aboral view; b, oral view of holotype (nat. size).

under arm-plates. The arm-spines are beautifully banded with light and dark; the exact shades differ in the different specimens; the ground colour ranges from nearly white to pale brown; the darker bands range from light brown, light red, or light greenish-brown to brown, red, and grey; the bands are narrow, well defined, especially at tips of spine, and numerous (five to ten). The under arm-plates, instead of showing a white median band, are, even from the first, prettily mottled with purplish-brown, bright brown, or grey and whitish or very pale brownish. The colour of the disk and upper surface of the arms shows considerable diversity; in typical specimens it is very light, almost white, the upper armplates being ornamentally marked with some light shade of brown or grey. In other specimens the disk is darker, and in one specimen it is the same shade of brown shown by small specimens of typical *O. canaliculata.* But

(39) *Pulcher*=beautiful, in reference to the ornamental colour pattern of the arm-spines.

regardless of the disk, the arm-spines and under arm-plates are absolutely distinctive.

Holotype: Reg. No. E. 470.

The specimens at hand range from 7·5 mm. to 18 mm. across the disk. The two largest have no locality label, but the others are all from Dr. Verco's collecting in Spencer or St. Vincent Gulf.

FAMILY OPHIODERMATIDAE.

OPHIURODON Matsumoto.

OPHIURODON OPACUM [40] sp. nov.

Disk 7·5 mm. in diameter; arms all broken, but no doubt more than 20 mm. long. Disk completely covered by a coat of fine but well-spaced spherical granules, about 150 to a square millimetre; these are somewhat coarser near the margin of the disk than at the centre; the coat of granules completely covers an underlying layer of rather delicate scales. Upper arm-plates, except for one or two at base of arm, longer than wide, at first broadly in contact, but becoming less and less so distally, until near tip of arm they are small and quite separate; distal margins curved, broadly so at base of arm, but becoming more and more semicircular distally; the plates are thick, dull, and without striations or other ornamentation.

Interbrachial areas below, oral shields, adoral and oral plates completely covered with a fine granulation like that of the disk, but coarsest on the jaws; the tips of the mouth angles are occupied by a group of six to nine granules, somewhat set apart from the rest, and occupying the space between the two lines of oral papillae. Oral papillae four on each side, placed somewhat on edge and overlapping, excepting the outermost, which is the smallest and least flattened; the other three are subequal, distinctly flattened, with rounded margin. Teeth very conspicuous, wide, with hyaline margin; there are apparently four in each column, but the lowest (outermost) is very short and broad, with an insignificant margin, while the next has a very conspicuous more or less serrate margin; in the holotype the median serrations are enough more conspicuous than the others to give the appearance of a triserrate tooth, but in the paratype this is not the case.

First under arm-plate small, wider than long, the second much larger, about as long as wide; succeeding plates becoming more and more evidently longer than wide, broadly in contact at first, but becoming less and less so, until

[40] *Opacus*=in the shade, obscure, in reference to the uncertainty as to the relationships.

at the tip of the arm they are well separated; the distal margin is markedly rounded, the proximal is narrower and truncate or (distally) pointed, and the lateral margins are more or less concave. Side arm-plates rather large proportionately, especially distally; each plate carries six or, on basal segments of arm, seven, opaque, solid but delicate, blunt, somewhat flattened arm-spines, about as long as the segment or a trifle longer; they show a tendency to lie appressed to the arm, but obviously are not normally so in life; the upper ones (except uppermost, which may be quite small) are longest, and are somewhat widened near but not at the tip. Tentacle-scales two, large, the inner the larger and more elliptical; the outer overlies the base of the lowest arm-spine, and distally tends to be quite pointed. On the first pore there are five scales, two of which guard the distal side; on the second pore are four scales, of which one is on the distal side; on the third pore are three proximal scales, but the distal scale is reduced or wanting; on the following pores a distal scale may be more or less indicated for several segments.

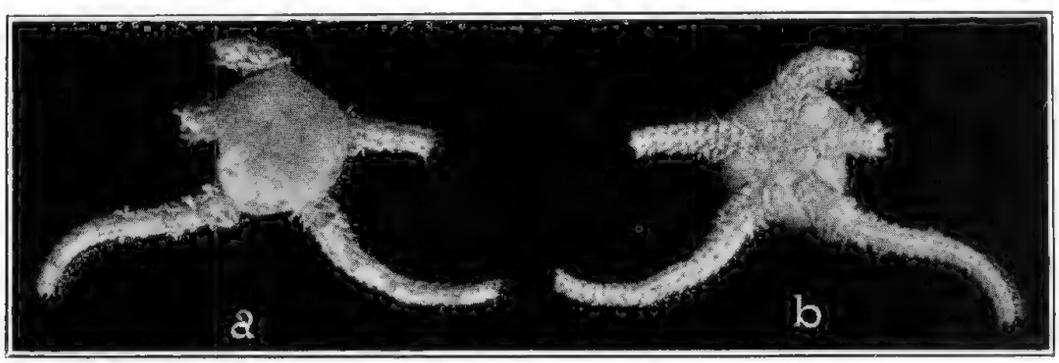

Fig. 132. *Ophiurodon opacum;* a, aboral view; b. oral view of holotype (x 2).

Colour of holotype very pale grey, the disk mottled with a darker shade; arms with five or six darker bands at irregular intervals; these bands are more than one segment wide, and the outer portion is darkest; lower surface nearly white. Paratype very pale brown or dirty-whitish, without any indications of bands on arms or of mottling on disk.

Holotype: Reg. No. E. 471.

There are only two specimens of this interesting brittle-star, one from Port Vincent, the other (holotype) being from the Verco collections from St. Vincent Gulf. The paratype is not quite 7 mm. across the disk, and the arms are about 23 mm. long; the arms are thus longer relatively than in the holotype, the arm-spines are a trifle longer and narrower, and the teeth are a trifle narrow and less evidently triserrate. This Australian *Ophiurodon* differs from the other members of the genus in the presence of two tentacle-scales and in the dull, unstriated arm-plates; indeed, the matter of the tentacle-scales has made me

hesitate to put the species in *Ophiurodon*, but in view of the disk covering, mouth parts, and arm-plates and spines, it seems unnecessary to erect a new genus for it, especially as *Ophiurodon* is itself so imperfectly known and its relationships so uncertain.

PECTINURA Forbes.

PECTINURA ARENOSA.

Lyman, Bull. M.C.Z., vi, 1879, p. 48.

There are nineteen specimens of this species from Tumby Bay; Ardrossan, Yorke Peninsula; between Trowbridge Lighthouse and Backstairs Passage; and the Verco collections in Spencer and St. Vincent Gulfs. They are all adults, with the disk 7 mm. to 11 mm. across; the arms are 3·5 to 4 times the diameter of the disk. There are eight or rarely nine arm-spines on the basal part of the arm of the smallest example, and ten or eleven in the case of the largest. A number of the specimens are uniformly very pale brown (or dirty cream-colour), without markings of any sort, but it is, of course, possible that these individuals have been more or less bleached in preservation. In other cases the disk is unicolour, brown, or grey of some shade, but the arms are more or less cross-banded, either light with dark bands or dark with light ones. The largest specimen has the disk dark grey mottled with light grey, and the arms dark with light bands, but the light and dark bands are of about equal width; oral surface of body nearly white, of arms mostly dull greyish-purple, with much less marked banding than on the upper surface.

PECTINURA ASSIMILIS.

Ophiopeza assimilis Bell, Proc. Zool. Soc., 1888, p. 282.
Pectinura assimilis H. L. Clark, Bull. M.C.Z., lii, 1909, p. 118.

There are fifteen specimens of this species from Tumby Bay and from the Verco collections in Spencer and St. Vincent Gulfs. Although obviously different from the preceding species, no one character will serve to constantly distinguish them. The present species is decidedly the larger (with disks up to 21 mm. in diameter), with stouter but not shorter arms; in specimens of the same size the arm-spines are fewer in *P. assimilis* than in *P. arenosa*, but in large specimens there are eleven and even twelve arm-spines; the spines are longer in *P. assimilis*, nearly equalling the segment, while in *P. arenosa* they are only about half as long as the segment; the upper arm-plates in *P. arenosa* have a markedly curved (convex) distal margin, while in *P. assimilis* the plates are shorter and wider, with a nearly straight distal margin; in *P. assimilis* the penultimate oral papilla in each series is conspicuously the largest, but in *P. arenosa* this is not noticeable; finally, and most obvious if not most important,

in *P. arenosa* supplementary oral shields are usually present distal to the oral shields, but in *P. assimilis* these are usually wanting. In one large *P. assimilis* in the present series, supplementary shields are present in every interradius, but they are wide and low, closely appressed to the oral shield, and four of the five are divided, three into two and one into three pieces.

In colour the two species must be quite unlike in life, for the best specimens of *P. assimilis* show a distinct rose-purple colour in markings on disk or arms, or at least on the oral shields and basal under arm-plates. The most highly coloured specimen is pale yellowish-brown, with the centre of the disk and about five indefinite bands on each arm, rose-purple; orally the general tint is dull cream-colour, but the interbrachial areas, oral shields, and basal under arm-plates show more or less evident markings of rose-purple. At the other extreme is a nearly white specimen, with disk 16 mm. across, and arms about 60 mm. long, which shows no markings on the upper surface, but is very evidently rose-purple on the oral shields and basal under arm-plates; it is impossible to say whether this specimen has been bleached or not, but it does not give that impression. On the other hand, the only specimen with no trace of rose-purple is a large one (disk, 21 mm.), with lower surface cream-colour and upper surface dull light grey and yellowish intermingled with little contrast; this specimen has probably had its colours altered by exposure to light and dust.

In my key to the species of *Pectinura* ([41]) I have said of *P. assimilis:* "arms not at all spotted or marked with purple. Arm-spines sub-equal; oral shields rather wider than long." Evidently this is wrong in the matter of the colour, and it is also unreliable as regards the oral shields, for sometimes the oral shields, in small specimens, are longer than wide. The differences between *P. assimilis* and *P. maculata* of New Zealand are, however, very evident, for *P. maculata* has the arms more than four times the disk diameter, and the upper arm-plates are conspicuously spotted with purple; in *P. assimilis* the rose-purple is more like a ground tint irregularly mottled with the lighter shade. If the single specimen of *P. assimilis,* long in the M.C.Z. collection, and said to be from South Australia, has not had its colours artificially altered in some way, the species shows considerable diversity, for there is no trace of rose-purple anywhere, but that colour is replaced by a bright brown, in contrast with the very pale yellowish-brown ground colour.

OPHIARACHNELLA Ljungman.

OPHIARACHNELLA GORGONIA.

Ophiarachna gorgonia Müller & Troschel, Sys. Ast., 1842, p. 105.
Ophiarachnella gorgonia H. L. Clark, Bull. M.C.Z., lii, 1909, p. 123.

([41]) H. L. Clark, Bull. M.C.Z., lii, 1909, p. 116.

There are two dry, bleached specimens labelled "N. Australian Coast"; as the species is common there, there is no reason to doubt the label. One specimen, 8 mm. across the disk, still shows plainly half a dozen light brown bands on each arm. The other is 11 mm. in disk diameter, and the cross bands on the arms are very faint.

OPHIARACHNELLA INFERNALIS.

Ophiarachna infernalis Müller & Troschel, Sys. Ast., 1842, p. 105.
Ophiarachnella infernalis H. L. Clark, Bull. M.C.Z., lii, 1909, p. 124.

This is another tropical species, of which three typical specimens, 9 mm. to 12 mm. across the disk, are in the present collection, from "N. Australian Coast." Their naturally dull colours have undergone little change.

OPHIARACHNELLA RAMSAYI.

Pectinura ramsayi Bell, Proc. Zool. Soc., 1888, p. 281.
Ophiarachnella ramsayi H. L. Clark, Mem. M.C.Z., xxv, 1915, p. 305.

One of the four specimens of this species (which was first described from Port Jackson) was taken by Dr. Verco. It is from either Spencer or St. Vincent Gulf, and, although dry, is well preserved; the colour is cream-colour and pale grey irregularly and indefinitely mixed, with three or four dark grey bands on upper surface of each arm, and many dark grey spots both on disk and arms; under surface pale cream-colour; it is probable that these colours are more or less faded; the disk is 23 mm. across, and there are eleven arm-spines on the basal segments.

The other specimens are obviously old and somewhat deteriorated. One with the label: "Presented by Rumball, Esq., Queenscliff, Kangaroo Island, December, 1901," has the disk 30 mm. across and the arms 150 mm. long; there are thirteen arm-spines on some basal segments; the colour is a variegation of light and dark yellow-brown, with many dark spots or dots on the lighter areas, and the arms more or less conspicuously banded. The other two specimens are labelled, "Presented by J. G. McDougall, Esq., Edithburgh, December, 1887." One has only four arms, as one has been broken off close to the disk, which is 29 mm. across; the point where the arm was lost has apparently healed, but there is no indication of regeneration; there are thirteen arm-spines. The other has the disk 32 mm. across, but the arms are only 125 mm. long; there are thirteen, rarely fourteen, arm-spines. The colour of these Edithburgh specimens is essentially the same as in the individual from Kangaroo Island, but the arms are less distinctly banded.

FAMILY OPHIOLEPIDIDAE.

AMPHIOPHIURA Matsumoto.

AMPHIOPHIURA COLLETA.

H. L. Clark, "Endeavour" Res., iv, 1916, p. 93.

It is interesting to find this species in the collection, but most disappointing to find only one specimen, and that but half-grown. This individual was taken by Dr. Verco in either Spencer or St. Vincent Gulf. The disk is 8 mm. across, and the arms were about 24 mm. long, as far as can be estimated, since all are broken. In the arrangement of disk-plates and arm-spines this specimen is like the holotype, but the upper and under arm-plates reveal its immaturity, since very few proximal plates are wider than long and fully in contact. The oral papillae too are immature, and not so distinctive as in the original specimen. The colour is not at all yellowish, but is greyish-white.

OPHIURA Lamarck.

OPHIURA KINBERGI.

Ljungman, Ofv. Kongl. Vet.-akad. Föhr., xxiii, 1866, p. 166.

This brittle-star was previously known from Port Jackson and Port Phillip, but its occurrence in the Verco collections from Spencer and St. Vincent Gulfs is a considerable extension of its range westward. There are seven specimens at hand, ranging in disk diameter from 5 mm. to 9 mm.; the arms are slender but short; it is doubtful if they ever exceed three times the disk diameter.

OPHIURA OOPLAX.

Ophiocten oöplax H. L. Clark, Bull. U.S. Nat. Mus., lxxv, 1911, p. 99.
Ophiura oöplax Matsumoto, Proc. Acad. Nat. Sci. Philadelphia, lxvii, 1915, p. 81.

The discovery of this Japanese species in the Verco collections from Spencer and St. Vincent Gulfs is most surprising. It is so well marked a species that there is no danger of mistaken identification, nor can I find any notable differences between Japanese and South Australian specimens. There are nine specimens in the Verco collection, and they range from 4 mm. to 8·5 mm. across the disk; the colour is uniform, grey or nearly white. In Japanese waters this brittle-star is common at depths of 94 fathoms to 614 fathoms, and has not been taken in shallower water. It would be very interesting to know at what depths the South Australian specimens were taken. No records of *O. oöplax* between Japan and South Australia exist.

OPHIOMUSIUM Lyman.

OPHIOMUSIUM ANISACANTHUM ([42]) sp. nov.

Disk 13 mm., arms broken, but apparently about 50 mm. long. Disk covered with a very smooth coat of closely appressed plates; at first there are a central plate, five radials, ten radial shields, ten plates in pairs, smaller proximal to larger, both long and narrow, lying in the interradii, separating the pairs of radial shields from each other, and ten plates in pairs, the distal much the smaller, lying in the radii, and separating the two radial shields of each pair; thirty-six plates in all; but with growth smaller plates come in at the angles where the larger plates meet each other, until 75 to 90 scales and plates may be counted on the disk of a full-grown specimen. Radial shields moderate, not much longer than wide, roughly rounded triangular, fully separated from each other both radially and interradially. All disk plates are apparently quite smooth, but under sufficient magnification are found to be very finely granular. Upper arm-plates present only basally; the first is large, pentagonal, almost twice as wide as long; the second is very much smaller, wider than long, triangular with the angle proximal; succeeding plates similar but smaller, and decreasing steadily in size from segment to segment, disappearing entirely at the tenth segment (or thereabouts) in large specimens, nearer to disk in smaller ones.

Interbrachial areas below completely covered by one huge marginal plate, the two genital plates, and the oral shield; the marginal plate is about twice as wide as long. Oral shields somewhat pentagonal, with distal side longest and perfectly straight; outer lateral margins about one-half of distal, very slightly convex; inner lateral margins slightly concave distally, a trifle convex proximally, meeting in a sharp angle. Adoral plates very large, nearly three times as long as wide, meeting fully within, wider without than within. Oral plates smaller than adorals; each carries four subequal squarish oral papillae, while a fifth one, considerably larger, is half on the oral and half on the adoral plate; at the tip of the jaw is a large unpaired, somewhat triangular papilla.

Under arm-plates, except first three, insignificant, triangular, wider than long, practically wanting after the first six or eight segments; second and third are practically the same shape as the oral shields, but are longer than wide, the second being relatively longer than the third; first under arm-plate not half as large as second, slightly hexagonal, a little wider than long, with proximal angle much larger and more acute than distal. Side arm-plates very large, composing practically the whole segment; each plate carries near the lower distal corner, but well back from the margin of plate, two arm-spines, placed close together,

([42]) ἄνισος=unequal + ἄκανθα=spine, in reference to the striking inequality of the arm-spines.

the lower cylindrical, blunt, almost half as long as a basal arm-joint; upper, peg-like, minute, not half as long as lower; on basal joints, a third, even smaller peg-like spine may be found near margin, well up on the plate, and occasionally a fourth, still smaller, is present between the lower pair and the upper single spine. Tentacle-pores in two pairs, beside second and third lower arm-plates, with a long, narrow, elliptical scale on the outer side, and a very much narrower and less noticeable one on the inner side. Colour, nearly white.

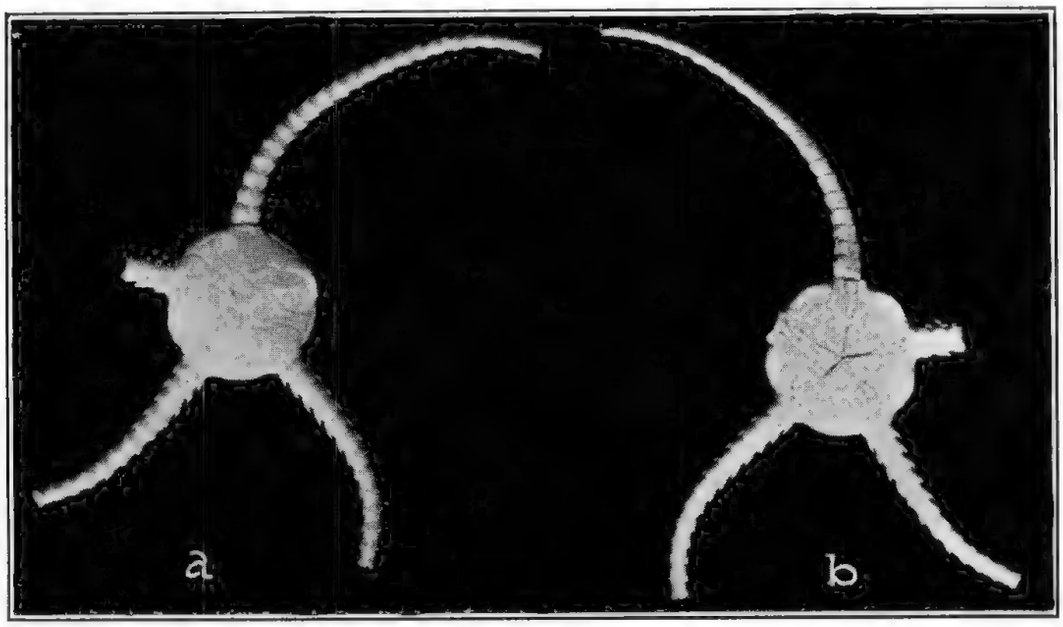

Fig. 133. *Ophiomusium anisacanthum;* a, aboral view; b, oral view of holotype (nat. size).

Holotype: Reg. No. E. 480.

There are five specimens of this well-marked species in the Verco collections from Spencer and St. Vincent Gulfs. The smallest is somewhat more than 9 mm. across the disk, while the arms (broken now) could not have much exceeded 30 mm. The species may be recognized at once among those with only two pairs of tentacle-pores by the combination of a single huge interbrachial plate orally, with only one arm-spine large and well developed enough to be called a spine.

OPHIOMUSIUM APORUM (43) sp. nov.

Disk 9 mm. in diameter; arms about 30 mm. long. Disk covered by about thirty-one large plates, including the radial shields, and many, small, triangular, ill-defined plates at their angles; all the plates are covered by a thick, wrinkled skin, but it looks as though the skin on each plate had dried and wrinkled by

(43) ἄπορος—without a pore, in reference to the apparent absence of tentacle pores.

itself. Radial shields small, separated. Upper arm-plates ten to twelve, but only the first two are worthy of mention; they are small, triangular, about as long as wide, the first the larger.

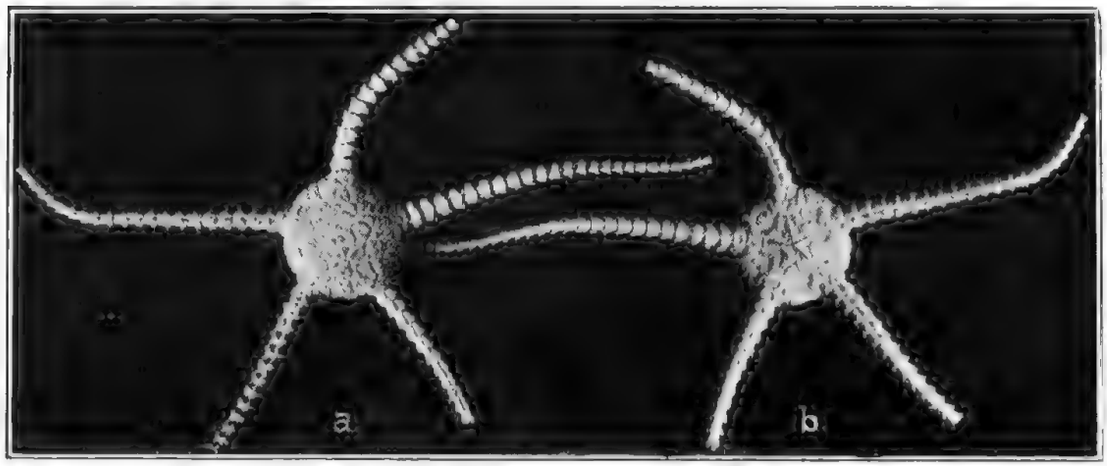

Fig. 134. *Ophiomusium aporum;* a, aboral view; b, oral view of holotype (x 2).

Interbrachial areas below covered by a large median and two smaller marginal plates, the two genital plates, and the oral shield; these plates are like those of the disk in appearing as though each were covered by wrinkled skin. Oral shields rounded pentagonal, with an angle proximally, about as long as wide. Adoral plates relatively large, short, and wide, meeting broadly within. Oral plates small and indistinct. Oral papillae apparently four or five, but difficult to distinguish separately, as they are more or less concealed in skin. First under arm-plate small, nearly square, second and third somewhat larger, roughly triangular; no under arm-plates present further out. Side arm-plates large, somewhat flaring distally; each carries three subequal, small, peg-like arm-spines not one-third as long as arm-segment; those near base of arm are more blunt and peg-like than distally, where they are quite acute. Tentacle-pores very difficult to make out, but present beside second under arm-plate, and probably also beside third; tentacle scales small, elliptical, difficult to make out on most pores. Colour pale greyish, nearly white.

Holotype: Reg. No. E. 481.

There are but two individuals of this curious species in the collection, both having been taken by Dr. Verco in Spencer and St. Vincent Gulfs. The paratype is obviously young, and shows some notable peculiarities. The disk is only 4 mm. in diameter, and the arms could hardly have exceeded twice that. There seem to be neither upper nor under arm-plates, and as a rule only one or two arm-spines are to be found on a side arm-plate. All over the plates of the disk

and those of the interbrachial areas below are minute, pointed granules; apparently these are worn down with growth, and more or less wholly disappear. There is no trace of tentacle-pores. It is not likely that this species will be confused with any other in the genus, as the apparent absence of tentacle-pores is quite unique.

OPHIOMUSIUM SIMPLEX var. AUSTRALE, var. nov.

Disk 14 mm. in diameter; arms probably about 50 mm. long. Differs from typical adult *O. simplex* (*O. sanctum* Koehler) in having more numerous, rounder, flatter disk plates, less swollen marginal plates, and fewer interbrachial plates orally. There is but a single specimen, and it is possible that it is only an

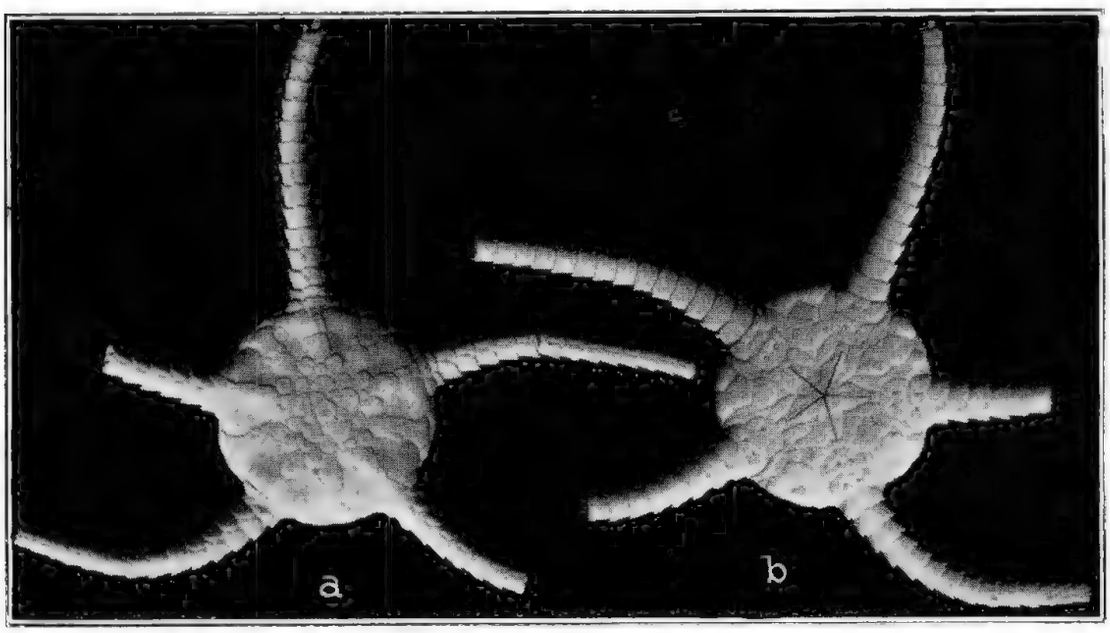

Fig. 135. *Ophiomusium simplex* var. *australe;* a, aboral view; b. oral view of holotype (x 2).

individual variant, but as it was taken by Dr. Verco in either Spencer or St. Vincent Gulf, while the typical form is known only from the East Indian region, it seems best to regard it as a southern variety until sufficient material is accumulated to determine its status accurately. Reg. No. E. 482.

OPHIOZONELLA Matsumoto.

OPHIOZONELLA ELEVATA.

Ophiozona elevata H. L. Clark, Bull. U.S. Nat. Mus., lxxv, 1911, p. 31.
Ophiozonella elevata Matsumoto, Proc. Acad. Nat. Sci. Philadelphia, lxvii, 1915, p. 82.

It seems very extraordinary that this Japanese species should occur in South Australian waters, but there are two specimens, taken by Dr. Verco, in the present collection. They came from either Spencer or St. Vincent Gulf. They agree with a Japanese paratype of *O. elevata* in all essentials, except that the arm-spines are longer and the upper arm-plates are more fully in contact and have a more convex distal margin. The length of the arm-spines is striking, as the upper one is nearly as long as two joints, but I cannot refer these specimens to *O. bispinosa* Koehler, as would seem natural, the difference in the upper arm-plates is so great. Koehler ([44]) thinks the shape of the oral shields may be an aid in distinguishing *O. elevata* and *O. bispinosa*, but I find enough diversity in *O. elevata*, where the shields may be longer than wide, as in *O. bispinosa*, to convince me this feature will not help us. Should further material show that *O. bispinosa* and *O. elevata* do not have the marked difference in upper arm-plates which Koehler's figures and description lead me to suppose, then *O. elevata* becomes a synonym of *O. bispinosa*, and both the Japanese and South Australian specimens must be referred to Koehler's species.

OPHIOCROSSOTA ([45]), gen. nov.

Disk covered with large smooth plates and scales, very regularly arranged and with primary plates conspicuous. Radial shields broadly in contact proximally but separated distally by a large triangular plate; outer margin of this plate and inner margin of distal half of radial shields provided with minute, crowded but distinct papillae, in a single series; the series on the radial shield is virtually (but not actually) continuous with the series of similar but larger papillae on the adradial margin of the genital plates. Upper arm-plates wider than long on basal part of arm and broadly in contact there. Oral shields very large occupying most of interbrachial areas below. Second pair of oral papillae opening outside of mouth slits guarded by tentacles scales on both sides. Under arm-plates somewhat swollen, separated from each other, on basal part of arm by a distinct pit. Arm spines numerous. Tentacle-pores very large, protected by a tentacle-scale and the lowest arm-spine, which are virtually side by side.

Genotype: *Ophiocrossota heteracantha* sp. nov.

This is a very remarkable genus, showing a combination of characters quite unique. The papillae on the radial shields suggest at once the West Indian genus *Ophiothyreus*, but in that case the radial shields are wholly separated, and distally by a pair of plates, lying side by side. Orally the

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([44]) Koehler, Bull. U.S. Nat. Mus., 100, v, 1922, p. 422.

([45]) ὄφις=snake+ κροσσωτὸς=fringed, in reference to the papillae on the radial shield margin.

Australian genus is utterly unlike *Ophiothyreus*, but reminds one very much of *Stegophiura*, from which, however, the character of the tentacle-pores instantly separates it.

OPHIOCROSSOTA HETERACANTHA (46) sp. nov.

Disk 11 mm. in diameter; arms broken, but probably about 40 mm. long, broad and stout at base, but tapering rapidly to a very slender tip (as shown by other specimens). Disk covered by twenty-six large, smooth plates, besides many small ones at their corners, the radial shields and five large marginal plates, one in each interradius. Radial shields large, nearly twice as long as wide, meeting broadly within, separated distally by a large triangular plate;

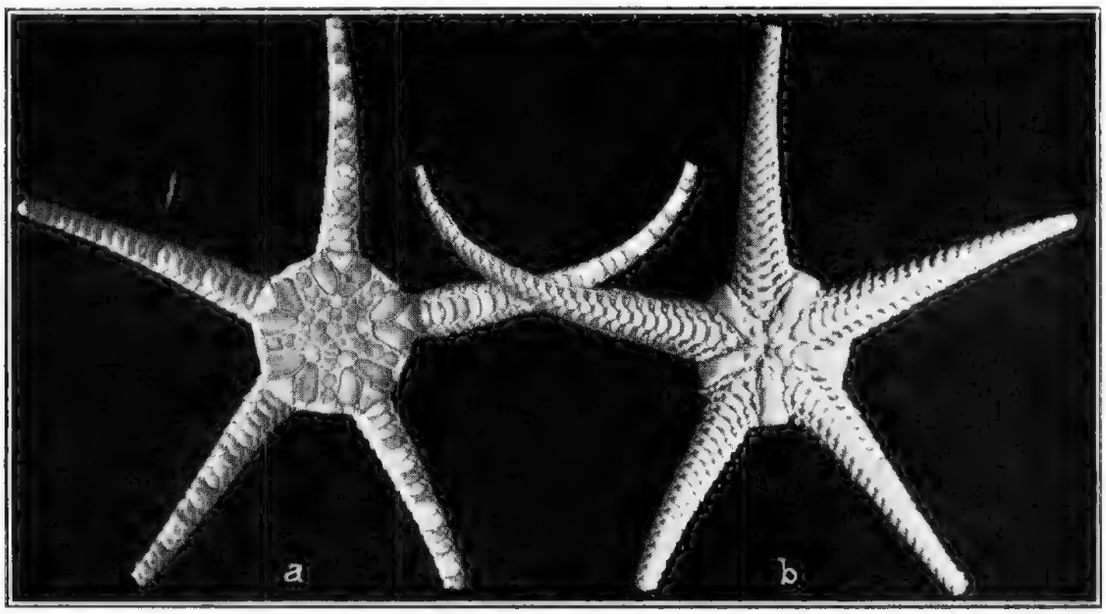


Fig. 136. *Ophiocrossota heteracantha;* a, aboral view; b, oral view of holotype (x 2).

on the margins of this plate and the distal inner margin of the radial shields are the fringes of minute papillae so distinctive of the genus. Upper arm-plates broadly in contact proximally, but distally they become small, triangular, and separated; first one very short and wide, as wide as the triangular plate that separates the radial shields, its length about one-fifth of its width; second plate not so wide, but twice as wide as long, with convex distal margin and moderate lateral angles; succeeding plates becoming more and more triangular, narrower, longer, but smaller.

Interbrachial areas below almost covered by the huge oral shields, which are more than twice as long as broad, sharply pointed proximally, but rounded

(46) ἕτερος=different+ ἄκανθα=spine, in reference to the dissimilar arm-spines.

distally; besides the shield, the only plates in the interbrachial areas are the broad genitals, the conspicuous marginal, and two or three small plates just distal to the oral shield; genital plates with a conspicuous fringe of ten to twelve papillae, the lower ones rather long, the uppermost much like those on the adjoining radial shields. Adoral plates rather small, but swollen, meeting broadly within. Oral plates conspicuous, swollen, larger than the adorals. Oral papillae small, about four on each side of each jaw, the distalmost largest, low, flat, and scale-like. Teeth about three, or possibly four, in a column, narrow, pointed.

First under arm-plate large, tetragonal, about as long as wide, but wider distally than proximally; second plate pentagonal with a sharp proximal angle, and rounded lateral margins and angles, much wider than long, somewhat swollen, separated from first plate by a large pit, and from third plate by a smaller one; next three plates similar but successively smaller; following plates about as long as wide, widely separated from each other, not swollen, and not separated by pits, becoming very small and nearly circular distally. Side arm-plates not very large, but thick at the oral end, not flaring; each carries a series of twelve or fewer spines, of diverse sizes; the third from the bottom is largest, cylindrical, blunt, about half as long as arm-segment; the uppermost and the lowest come next, and are about three-fourths as large; the next to lowest and the one above the largest are next in order, while the others passing from below up become successively smaller, the next to uppermost being smallest and hardly a quarter the size of the uppermost. First tentacle-pore (second oral) opens outside mouth-slit, and is protected by two low, broad, flat scales on each side; succeeding pores very large, with a single, thick, rounded scale on the side arm-plate, and on the first two or three pores a minute scale in the angle where the distal margin of the under arm-plate touches the side arm-plate; the lowest arm-spine stands beside the tentacle-scale, and it and the one above it apparently function as tentacle-scales. Colour pale brown or nearly white, with radial shields and sometimes the central plates a distinctly darker shade; groups of from one to four upper arm-plates are also a darker brown, so that the arms appear banded; lower surface uniformly white, whitish, or pale brown; the variegated upper surface is more or less strikingly ornamental.

Holotype: Reg. No. E. 484.

This is a pretty and interesting brittle-star, apparently common in St. Vincent and Spencer Gulfs, where fifty-three specimens were collected by Dr. Verco. It is remarkable that so striking a form should have so long gone undescribed. It cannot possibly be confused with any other Australian brittle-star, and, indeed, there is nothing like it to be found elsewhere. It is unfor-

tunate that we do not know at what depth it occurs; it does not look like a deep-water form.

OPHIOLEPIS Müller & Troschel.

OPHIOLEPIS SUPERBA.

Ophiura annulosa Blainville, 1834, *not* Lamarck, 1816.
Ophiolepis superba H. L. Clark, Spolia Zeylanica, x, 1915, p. 89.

There are twenty adult specimens in the collection, all dry. There are no locality labels for fourteen, but six are said to be from "Spencer Gulf." This is almost certainly a mistake, as the species is a strictly tropical one. Probably all the specimens are from the coast of the Northern Territory. The smallest is 15 mm. across the disk, and the arms are rather more than 40 mm., while the largest has the disk diameter 25 mm., and the arms exceed 80 mm.

OPHIOPLOCUS Lyman.

OPHIOPLOCUS IMBRICATUS.

Ophiolepis imbricata Müller & Troschel, Syst. Ast., 1842, p. 93.
Ophioplocus imbricatus Lyman, Proc. Boston Soc. Nat. Hist., viii, 1861, p. 76.

There are four specimens of this easily recognized species, but they have no locality label. There is little doubt, however, that they are from the coast of the Northern Territory, as it is highly improbable that the species occurs on the southern coast of Australia. The present specimens measure from 11 mm. to 16 mm. across the disk.

ECHINOIDEA

There are 1,519 sea-urchins in the collection, representing forty-six species and two varieties, but seventeen specimens, representing the following ten well-known species, are non-Australian in origin:

Psammechinus microtuberculatus (Blainville)
Echinus esculentus L.
Paracentrotus lividus (Lam'k.)
Evechinus chloroticus (Val.)
Strongylocentrotus purpuratus (Stimp.)
Heterocentrotus trigonarius (Lam'k.)
Arachnoides zelandiae (Gray)
Dendraster excentricus (Esch.)
Mellita quinquiesperforata (Leske)
Brissus latecarinatus (Leske)

No further reference will be made to these species.

Of the remaining thirty-eight forms, six species are described as new, and one of these represents an extraordinary new genus in the family Arachnoididae, which has hitherto contained but a single genus. This new form looks, at first glance, like a scutellid, and particularly like the common sand-dollar *(Echinarachnius)*, but more careful examination shows that it is really quite close to *Arachnoides*. There are two species, *Phyllacanthus irregularis* and *Apatopygus recens*, which are here recorded from Australia for the first time.

Only twenty-five of the thirty-eight forms are certainly from the southern coast of the continent, while three are from the western and ten from the northern or north-eastern coasts. One of the west coast species is known from the southern coasts and Tasmania, while the other two are extremely rare forms, whose presence in this collection is particularly noteworthy; one *(Apatopygus recens)* is a New Zealand species of a monotypic genus, and the other *(Gonimarelia interrupta)* has been known hitherto only from the unique holotype in the Berlin Museum, which came from Western Australia; unfortunately the present specimen has no locality label. The ten northern or north-eastern species are well-known tropical forms, though one *Arachnoides placenta*, has a peculiar distribution, the limits of which are not yet well marked out.

More than two-fifths of the specimens belong to three species of the family Fibulariidae, while nearly half the remainder are Temnopleurids. There are ten species, which have 1,294 specimens, or an average of almost 130 for each, while on the other hand there are thirteen species represented by only one specimen each, and two of these are hitherto undescribed species.

Horizontal diameter is abbreviated to "h.d." in the following pages, while "v.d." refers to the vertical diameter.

ORDER CIDAROIDA

FAMILY CIDARIDAE.

PHYLLACANTHUS Brandt.

PHYLLACANTHUS IRREGULARIS.

Mortensen, Vid. Medd. Dansk. Naturhist. Forening, Copenhagen, lxxxv, 1928.

There are five large individuals of *Phyllacanthus* which Dr. Mortensen has examined and found to belong to his new species. Unfortunately they have no locality labels, so that it is impossible to say from what part of the Australian coastline they come. As no specimens of *Phyllacanthus* have been recorded from Australia south of Port Hacking, on the east, and Fremantle on the west, it seems

probable that the present specimens are from the coast of the Northern Territory. They range from 71 mm. to 101 mm. in diameter, and in four of the specimens the primary spines are less than 50 mm. long. In the fifth individual, however, they are nearly 60 mm. long, and are conspicuously more tapering and pointed than in the others; their surface is also smoother, the coarse granules having the appearance of being flattened or ground down by friction, and the whole spine more or less overlaid by a deposit of some sort. But as the primaries are rust-colour, and the whole animal is dull and orally quite rusty, there can be little doubt that some misfortune in preservation accounts for this colouration and for the appearance of the primaries.

The character of the secondary and miliary spines distinguish *P. irregularis* from *P. imperialis* or its variety *parvispinus* very easily, for they are pointed and narrow, and show great diversity of size, instead of being blunt, wide, and scale-like, as in the long-known forms. It is worthy of note also that *P. irregularis* has nine or ten coronal plates in a column in all these specimens, whereas *P. imperialis* and var. *parvispinus* very rarely indeed have more than seven, even in the largest individuals.

PHYLLACANTHUS sp. ?

A defective, but large, bare test of a *Phyllacanthus*, which measures 80 mm. in diameter, has but seven coronal plates in a column. It is probably *P. parvispinus*, but may be *P. imperialis*. As it lacks distinctive characters as well as locality label, its identification must be left unmade.

PRIONOCIDARIS A. Agassiz.

PRIONOCIDARIS BISPINOSA.

Cidarites bispinosa Lamarck, Anim. s. Vert., iii, 1816, p. 57.
Prionocidaris bispinosa Döderlein, Abh. Senck. Nat. Ges., xxxiv, 1911, p. 240.

There are five specimens which I refer to this beautiful northern Australian species. There are no locality labels, but probably all came from the Northern Territory. The finest individual is 40 mm. in h.d., and has magnificent primaries, some of which are more than 90 mm. long. Of the five specimens, two are bare tests, 20 mm. and 37 mm. h.d., lacking their apical disks.

GONIOCIDARIS Agassiz & Desor.

GONIOCIDARIS GERANIOIDES var. TUBARIA.

Cidarites tubaria Lamarck, Anim. s. Vert., iii, 1816, p. 57.
Goniocidaris geranioides var. *tubaria* H. L. Clark, Cat. Rec. Ech. Brit. Mus., 1925, p. 31.

There is a notable series of this common sea-urchin, and it is interesting to find that all are of the variety *tubaria;* there is not a typical *G. geranioides* in the collection. The smallest specimen is 7 mm. in diameter, and has only five plates in each interambulacral column; the largest is 58 mm. h.d. and 38 mm. v.d., and has thirteen such plates. So far as I can ascertain, this is the largest specimen of either *G. geranioides* or its variety *tubaria* that has been recorded. Large specimens usually have ten or eleven plates in each column, but there is great diversity in the relative height of the test; a specimen 20 mm. in diameter is only 11 mm. high, another is 34 mm. by 18 mm., and another is 39 mm. by 20 mm.; on the other hand a specimen 41 mm. h.d. is 34 mm. high, and another 34 mm. h.d. is 31 mm. high; thus the relative height of the test runs from about ·53 to ·91 h.d. But the greatest diversity is found in the character of the primary spines; so extraordinary is this that one is tempted to find some sort of distinctive characters in these primaries. But I am convinced this is a vain quest, so abundant and so complete are the intergradations. It is not difficult to group the specimens roughly into those with relatively slender, unexpanded spines with few, small prickles or none; those with moderately stout or slender spines, with few or no prickles, but with the tips of some, at least, of the dorsal spines, conspicuously expanded into shield-like tips; and those with short, stout, and very prickly or coarsely thorny spines. Most of the specimens fall into the third section, but there are all sorts of mixtures of the various characters, so that none of the sections are well-defined. As a representative of the first section is a specimen 48 mm. h.d., in which the primary spines are 25 mm. to 30 mm. long, 2 mm. to 2·5 mm. in diameter, and little or not at all expanded at tip. A specimen of the second section is 25 mm. in diameter, the spines in the mid-zone are about 18 × 2·5 mm., with more or less conspicuous prickles, and the aboral spines are 7 mm. to 8 mm. long and about 5 mm. across the expanded tips. An individual 20 mm. in diameter is an extreme illustration of the third section, for its principal primary spines are about 16 mm. long, 6 mm. or more wide, and many of the thorns they bear are 2 mm. long. In many individuals with thorny spines these become the points of attachments for barnacles, worm-tubes, bryozoa, and sponges, which are frequently large enough or numerous enough to give the animal a curiously bizarre appearance.

The most interesting and valuable of all the specimens in the collection is the one which has already been mentioned as measuring 31 mm. high, although it is only 34 mm. in diameter. In addition to its exceptional height, this individual is almost perfectly tetramerous; only on the peristome is there any evidence of a fifth area. This curious specimen has been figured and fully described in a paper by Dr. Robert T. Jackson ([47]), dealing with non-pentamerous variants among echini.

([47]) Mem. Boston Soc. Nat. Hist., viii, 1927, pp. 507-509, figs. 48, 49, 49a.

Very few of the specimens have any locality label. There is one from Queenscliff, Kangaroo Island, and two young ones from off Cape Jaffa in 90 fathoms. From off Cape Marsden, in 17 fathoms, Dr. Verco collected four very young bare tests, and there are some additional specimens from Dr. Verco's collecting in Spencer and St. Vincent Gulfs. Finally, the remarkable tetramerous specimen and a somewhat larger but notably high individual are from "South Melbourne, Victoria, 1889. Presented by J. W. Syke, Esq."

ORDER CENTRECHINOIDA

SUB-ORDER STIRODONTA

FAMILY STOMOPNEUSTIDAE.

STOMOPNEUSTES Agassiz.

STOMOPNEUSTES VARIOLARIS.

Echinus variolaris Lamarck, Anim. s. Vert., iii, 1816, p. 47.
Stomopneustes variolaris Agassiz, Mon. Ech. Anat. Echinus, 1841, p. x.

A single bare test, 80 mm. in diameter, pale drab in colour, is the only representative of this species. As there is no locality label, its origin is unknown, but the species occurs on both the eastern and northern coasts of Australia.

SUB-ORDER CAMARODONTA

FAMILY TEMNOPLEURIDAE.

GENOCIDARIS A. Agassiz.

GENOCIDARIS INCERTA ([48]) sp. nov.

Test 6 mm. h.d.; 3 mm. v.d.; the height of test runs from ·50 to ·60 h.d. Coronal plates, and ambulacral plates, each nine or ten in a column. Arcs of pores just enough curved so that the adradial margin of the poriferous area is not perfectly straight. Abactinal system about 3 mm. across; ocularis all exsert, especially II, III, and IV; I is nearest insert. Periproctal plates wanting. Madreporic plate not enlarged (genital three is just as big) and madreporic pores few. Genital pores evident, but ocular pores more difficult to find. Ocular and genital plates rough, with a few, low, indistinct tubercles. Sculpturing of test visible only under high magnification, of little significance. Primary tubercles large, smooth, imperforate, several times larger than any

([48]) The poor condition of the material is the cause of uncertainty as to the status of this new form.

of the secondaries. Peristomal membrane and buccal plates wanting. Gill-slits barely indicated. Colour greenish and whitish or very pale yellow.

Holotype: Reg. No. E. 623.

There are sixty-three specimens of this little urchin at hand, ranging in size from less than 3 mm. to more than 8 mm. h.d. As only two have an oculogenital ring, and not one has the periproctal plates or the buccal membrane present, it is obvious that even the genus is uncertain. The reason for calling it *Genocidaris* is the very close resemblance to *G. maculata*, of the West Indies. It is so similar in form, tuberculation, and colour that it is only when specimens of the same size are examined critically side by side under a lens that the difference becomes clear. The Australian form has the sculpturing reduced to a minimum (one might very naturally call it wanting), the adradial margin of the poriferous areas is not so sharply cut as in *G. maculata*, and most obvious, the primary tubercles of *G. incerta* are very much larger both actually and relatively. Apparently the abactinal system is smaller in *G. incerta*, but this difference may not be constant, and certainly cannot be expressed in figures. Of course, it cannot be certain that the Australian form belongs in *Genocidaris* until specimens with periproctal plates and peristomal membrane are taken and studied.

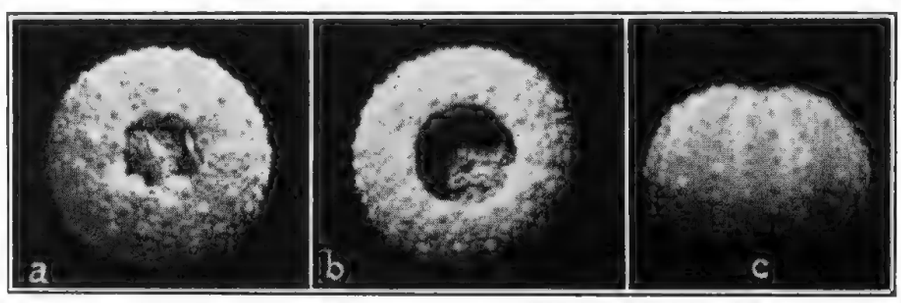


Fig. 137. *Genocidaris incerta;* a, aboral view of holotype (x 4); b, oral view, and c, side view of paratype (x 3).

All of the sixty-three specimens are bare tests, nearly all with no oculogenital ring. They were taken by Dr. Verco in his dredging at the following places: off Cape Borda, Kangaroo Island, 60 fathoms; off Cape Jaffa, 90 to 300 fathoms; off Beachport, 110 to 200 fathoms.

TEMNOPLEURUS Agassiz.

TEMNOPLEURUS AUSTRALIS [49] sp. nov.

Test 20 mm. h.d., 10·5 mm. v.d., rather flat, with ambitus circular, or rounded pentagonal in some large specimens, and peristome little or not at all

[49] *Australis*=southern, in reference to its being the southernmost species in the genus.

sunken. In some individuals the dorsal flattening is very marked, in others the abactinal surface is distinctly conical, though low. Coronal plates seventeen or eighteen in a column, with distinct but not large triangular pits at each of the lower corners, except in the case of the two or three uppermost and one or two of the lowest; above ambitus each plate carries near its centre a large, imperforate, non-crenulate, primary tubercle, one or two secondaries near its inner end, and two or three small secondaries near the outer margin; at ambitus and below, excepting only the lowest two plates, each plate carries a horizontal series of three primaries, above which is a well-spaced series of half a dozen small secondaries or miliaries. Ambulacral plates also seventeen or eighteen in a column, with relatively large pits at the inner lower corner (excepting only the oldest and youngest plates), smaller ones at the outer corners, and a very small pit half-way between each pair of larger ones; there are two or more small tubercles on each plate, especially below the ambitus. Poriferous areas nearly straight, but the middle pair of pores in each arc is set out a little further from the mid-radius than are the other two; pores large, almost as large as the largest pits, set near together, the distance between them much less than diameter of a pore.

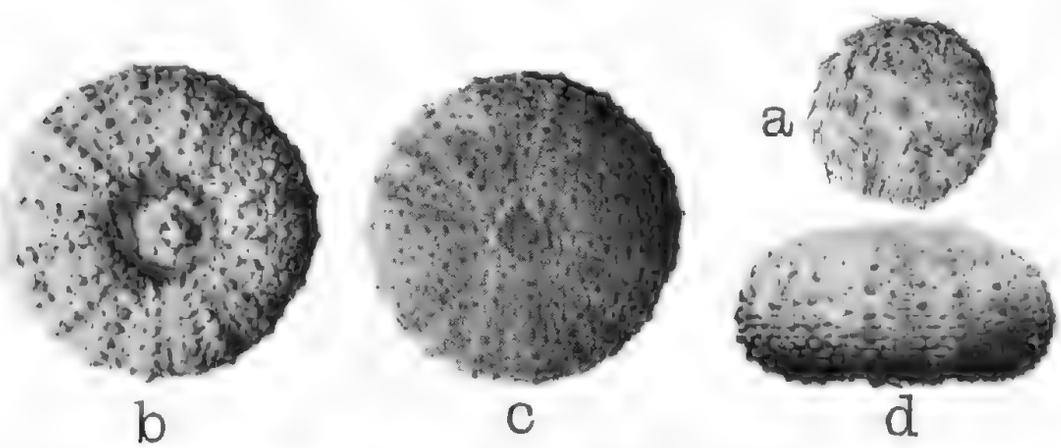


Fig. 138. *Temnopleurus australis*; a, aboral view of holotype (nat. size); b, aboral view, c, oral view, and d, side view of paratype (x 2).

Abactinal system large, about 6 mm. across; ocularis all completely exsert; genitals with five secondary tubercles set side by side along the inner margin, and no other tubercles on the plates; madreporite conspicuous, but not larger than genital three; genital pores large, at centre of each plate; ocular pores small, horizontal slits, distal to centre of plate, overhung by a small swelling, back of which is a small secondary and a number of miliary tubercles. Periproct large, about 3 mm. across, covered by numerous small polygonal plates, among which a suranal can be easily distinguished; anus excentric near ocular I. Peristome

about 7 mm. across, with very shallow and insignificant gill-cuts; membrane thin and bare, save for the five pairs of very small buccal plates and a few minute, scattered plates proximal to them. Primary spines 3 mm. (dorsally) to 5 mm. (orally) long, slender, pointed. Pedicellariae of all four kinds present; the globiferous resemble very closely those of *T. reevesii*, while the tridentate are much like those of *T. tarcumaticus;* neither the ophicephalous or triphyllous show any distinctive features. Spicules seem to be very scarce; I found none in the heads of the globiferous pedicellariae which I examined, and only a few in the tube-feet; all that were seen were bihamate. Colour of test grey, a darker shade usually somewhat variegated with a paler one; often there is a more or less evident green tinge, especially on the periproct; primary spines dull red-violet or purplish-red, more or less markedly green-tipped, and in long spines the green may fade into whitish at the extreme tip; secondary spines white, and occasionally some of the oral primaries are white.

Holotype: Reg. No. E. 464.

There are one hundred and forty-eight specimens of this little *Temnopleurus*, ranging in size from 5·5 × 3 mm. to 22 × 12 mm. There is considerable diversity in the form of the test, some individuals being so flattened that the height is little more than half the diameter, while others are more elevated, with the height exceeding two-thirds of the diameter. In one case the diameter is 16 mm. and the height 12 mm., but this specimen is somewhat deformed as a result of lateral pressure. There is considerable diversity in the abactinal system and in the pits and tubercles of the test; the ocular pores are not always slit-like, and may be quite evident; there is usually a pit at the proximal angle of each ocular plate, and this may be very conspicuous, but it is often entirely wanting; in one specimen, 19·5 mm. in diameter, ocular I reaches the periproct, but I have found no other specimen in which it even approaches such a condition; the pits in the test vary very much in size in different specimens, and there is also some diversity in the size of the primary tubercles. Diversity in colour is shown, due to the number of small spines and the purity of their whiteness; age is also a factor, for in small specimens the primaries are quite red at base, with no trace of violet, and there is no indication of green; these light-coloured little urchins, with nearly white tests and whitish spines, the larger ones with red on the basal half, look quite unlike the duller and darker adults, with their violet-red and green spines.

There is no doubt that this species is nearly allied to *T. reevesii*, but apparently the differences are constant. With the spines on, the colour alone distinguishes them easily. The bare tests may be distinguished by the smaller tubercles in *T. australis*, especially in the ambulacra in the midzone, and the more symmetrical abactinal system with the more completely exsert ocular I.

It is noticeable in many specimens of *T. australis* that the primary tubercle on an ambulacral plate in the midzone is of approximately the same size as, or not much larger than, the secondary tubercle at the inner end of the same plate, whereas there is a marked contrast in the sizes of the same tubercles in *T. reevesii*.

This species is apparently common on the coasts of South Australia, for while most of the specimens have no locality label, the following localities are represented: Spencer and St. Vincent Gulfs (Verco); Port Lincoln; Investigator Strait, 14 fathoms; Wallaroo Bay, 15 fathoms (Verco); Yankalilla Bay, 20 fathoms (Verco); St. Vincent Gulf; Backstairs Passage, 22 fathoms (Verco); between Trowbridge Lighthouse and Backstairs Passage. It is probable that *australis* extends its range to Western Australia, for there is very little doubt that the bare tests of a *Temnopleurus* which I recorded in 1914 ([50]) from Fremantle Beach are to be referred to this species; these tests are more brightly coloured than in any of the specimens before me, but that may be in part artificial.

SALMACIS Agassiz.

SALMACIS VIRGULATA var. ALEXANDRI.

Salmacis alexandri Bell, Zool. "Alert," 1884, p. 118.

Salmacis virgulata var. *alexandri* H. L. Clark, Cat. Rec. Ech. Brit. Mus., 1925, p. 88.

There are two specimens of this variety, one a bare and somewhat broken test, 57 mm. h.d., and the other a fine specimen, 47 mm. h.d., with primary spines 10 mm. long. The bare test is labelled "N. Territory," the other "N. East Australia." The two agree in the colouration of the test, and in the deep horizontal furrows so characteristic of the variety. The test is fundamentally white, and in the fine specimen is predominantly so; the spines too are pure white (possibly more or less bleached); the margins of all the horizontal furrows are light yellow-green, and the whole of the abactinal system and the adjoining coronal plates are of the same shade. In the bare test the green is more plentiful, and below the ambitus the general colour is light green with white tubercles.

MICROCYPHUS Agassiz & Desor.

MICROCYPHUS ANNULATUS.

Mortensen, Dansk. Selsk. Skr., (7) i, 1904, p. 101.

There are fifteen specimens of this lovely little sea-urchin, all taken by Dr. Verco; one is from Investigator Strait, 14 fathoms, while all the others are

([50]) Rec. W.A. Mus., i, 1914, p. 164.

from Spencer or St. Vincent Gulf; in only one case, however, is the depth given, and that one is from 20 fathoms. The specimens range in size from 12 x 10 mm. to 19 x 16 mm. or 19 x 17·5 mm.; the lowest specimen is 13 x 9·5 mm. Some of the specimens are darker than others, the test and basal part of the small spines being of a deeper shade, but on the whole the colouration is very constant. The primaries are pure white distally, a less pure shade basally; the coloured ring on the proximal half of the spine is very bright red distally, but is more or less dull, and often brownish or even greenish proximally.

MICROCYPHUS COMPSUS.

H. L. Clark, Mem. M.C.Z., xxxiv, 1912, p. 322 (as a substitute for *M. elegans* Mortensen, preoccupied).

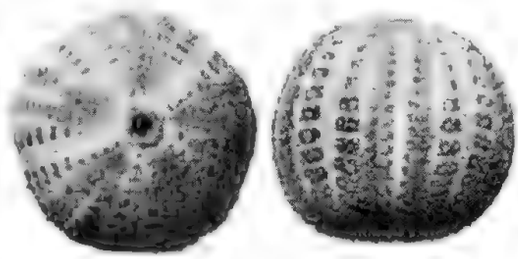
There are five bare tests of a *Microcyphus* which seem to represent this species. Of these, one from Spencer Gulf is 15 mm. h.d., and rather more than 13 mm. high; it is perfectly symmetrical, with a circular ambitus, and is in fine condition; the colour is dull rose-red, becoming dusky brown on the tubercled portion of the plates, while the tubercles themselves are a dirty greenish-white; this specimen is labelled *M. zigzag*. Another specimen, from St. Vincent Gulf, is similar in colour, but is duller; it is 11 x 9 mm., and lacks the entire abactinal system. Specimens dredged in 60 fathoms off Cape Borda, Kangaroo Island, and in 130 fathoms off Cape Jaffa, by Dr. Verco, are a trifle larger than this, lack the abactinal system, have holes in the test, and are so light coloured, with only a rosy tinge on the bare portions of the plates, that they are probably much bleached. The smallest specimen, 8 x 6 mm., dredged by Dr. Verco in Backstairs Passage, 23 fathoms, is in good condition, and is notable for its colouration; the red is not at all "rosy," and the tubercled part of the plates is much lighter (instead of darker, as usual) than the red bare portion. On the whole this individual raises the question whether *compsus* and *zigzag* may not intergrade in colour, at least when young.

MICROCYPHUS PULCHELLUS (51) sp. nov.

Test 12·5 mm. in diameter, 11 mm. high; abactinal system, 2·75 mm. across, with periproct about 1·50 mm.; peristome, 4·5 mm. in diameter. Test wholly bare, with no trace of spines, pedicellariae, or buccal membrane. Oculars all exsert; genitals each with two large tubercles on inner margin, excepting the rather conspicuous madreporite, which has only one, and that at the corner; periproct with numerous small, round plates (mostly missing); one, adjoining genital 3, is noticeably the largest of those present. Coronal plates seventeen

(51) *Pulchellus*=beautiful in reference to the very fine colouration.

or eighteen in a column, commonly with one large primary tubercle and four or five small secondaries, of which three are on the outer half; the bare interambulacral space is narrow, and the uppermost plates have a small tubercle located in it. Ambulacral plates twenty-seven or twenty-eight in each column, each with a primary tubercle near middle, and some seven or eight very small tubercles in two horizontal series on outer half of plate; inner half of plate bare and smooth in midzone, but rarely with a very small tubercle near upper margin; poriferous areas broad (narrow at peristome), equalling half the plates; interporiferous tubercles so small as to be insignificant. Interambulacra are nearly 4·5 mm. wide in midzone; ambulacra scarcely 4 mm.



a b

Fig. 139. *Microcyphus pulchellus;* a, aboral view; b, side view of holotype (x 2).

Margins of all test plates, except near peristome, broadly white; entire surface of all the uppermost coronal plates white with a reddish tinge; lowermost plates and central portion of the others (except uppermost) rich reddish-brown; upper ends of ambulacra dull reddish-brown, merging into the greyish-brown of the abactinal system.

Holotype: Reg. No. E. 628.

There is but a single specimen of this striking form, a bare test from Spencer Gulf. Its colouration is so different from that of any other *Microcyphus* I have ever seen, I do not doubt that it represents a distinct species. But it must be admitted that large series of specimens of *Microcyphus* may show that the colour differences, which with our scanty material seem so useful, are really neither so important nor so constant as could be desired.

MICROCYPHUS ZIGZAG.

Agassiz and Desor, Ann. Sci. Nat. (3), vi, 1846, p. 358.

A little, bare test of a *Microcyphus*, 10 mm. h.d. and 8·5 mm. high, seems to be a young individual of this species. The inner half of the plates in both ambulacral and interambulacral areas is dark yellow-brown, while the outer half is light flesh-red; the tubercles in both areas are a light, dingy cream-colour. This specimen was taken by Dr. Verco in 23 fathoms of water in Backstairs Passage.

AMBLYPNEUSTES Agassiz.

AMBLYPNEUSTES FORMOSUS.

Valenciennes, Voy. "Venus," Zooph., 1846, pl. ii, fig. 2.

There are four small *Amblypneustes*, which must be referred to this species, but they do not make its validity any more certain. They range in size from 7 x 5·5 mm. to 16 x 15 mm., and agree in having bright red primary spines, small, white periproctal plates, carrying no spinelets, and dark brown rhomboidal areas at the outer ends of the coronal plates. The ground colour of the test ranges from light fawn-colour to brown. The characteristic zigzag lines are more or less well developed on the bare interambulacral areas. The specimens are all from Dr. Verco's collections in Spencer and St. Vincent Gulfs.

AMBLYPNEUSTES OVUM.

Echinus ovum Lamarck, Anim. s. Vert., iii, 1816, p. 48.
Amblypneustes ovum Agassiz, Mon. Ech. Anat. Echinus, 1841, p. ix.

There are thirty-six specimens, either without locality labels or from the Verco collections in St. Vincent and Spencer Gulfs, which I am referring to the typical form of this species, and few of them give any cause for hesitation. A specimen 31 mm. h.d. is only 25 mm. v.d., its height being thus only ·80 of its diameter, but the tuberculation and the general colouration and appearance do not warrant assigning it to either of the varieties. The specimens range in size from 11·5 x 10 mm. to 62 x 57 mm.; aside from the one just mentioned the lowest is 37 x 31 mm., or ·84, while the highest is 40 x 47·5 mm., or 1·19. In nearly every specimen, whether dry or alcoholic, the test is greyish-green, the spines more or less pale green or greenish-white, and the tube-feet darker than the test. Even in the smallest specimens, spinelets (at least one or two) can be found on the thick, periproctal plates. One specimen, 20 x 13 mm., is curiously deformed, resembling *Echinostrephus* in its rounded pentagonal ambitus, which if not actually above the equator is nearly so; the periproct is also unnaturally elevated.

After repeated study of all the *Amblypneustes* in this collection, I am unable to improve on the grouping adopted in the British Museum catalogue ([52]), but I do not for a moment suppose that that grouping expresses the true interrelationships of the various forms. Only much larger collections, with exact field-notes, can give us the light we need.

([52]) H. L. Clark, Cat. Rec. Ech. Brit. Mus., 1925, p. 28.

AMBLYPNEUSTES OVUM var. GRANDIS.

Amblypneustes grandis H. L. Clark, Mem. M.C.Z., xxxiv, 1912, p. 329.
Amblypneustes ovum var. *grandis* H. L. Clark, Cat. Rec. Ech. Brit. Mus., 1925, p. 99.

There are two fine specimens from St. Vincent Gulf which certainly represent this variety. In one the height (62 mm.) is ·82 of the diameter (75 mm.), but in the other, which measures 89 x 61 mm., it is only ·69. This specimen is the largest *Amblypneustes* recorded. It has the test dark grey-brown (darkest near abactinal system), and the primary spines are pale red. The smaller specimen is somewhat lighter coloured, with the primaries a very pale red.

AMBLYPNEUSTES OVUM var. PACHISTA.

Amblypneustes pachistus H. L. Clark, Mem. M.C.Z., xxxiv, 1912, p. 327.
Amblypneustes ovum var. *pachista* H. L. Clark, Cat. Rec. Ech. Brit. Mus., 1925, p. 99.

This is a heterogeneous lot of eighteen *Amblypneustes*, ranging in size from 7 x 4·5 mm. to 41 x 33 mm., and in colour from the green and grey shades of typical *A. ovum* to the brown and red shades of *A. formosus*. To be sure, no specimen has the colour markings of *A. formosus*, nor are the spines so deep a red, but the red is sufficiently conspicuous to make the contrast with *A. ovum* striking. The only features that these specimens have in common are a relatively low test, coarse tuberculation, and spinelets on the periproctal plates. A specimen 20 mm. in diameter is only 12·5 mm. high, while another 21·5 mm. h.d. is 17 mm. high; this range of height from ·62 to ·79 h.d. is illustrative of the heterogeneity of the variety. A specimen 8 x 5·5 mm. has the primary spines bright violet, and there is room for doubt as to whether it ever had spinelets on the periproct, but it is certainly much nearer *A. pachista* in form and general appearance than it is to any other described variety. It is not unlikely that some of the specimens here referred to *A. pachista* are really young *A. grandis*, but at present we know too little about growth changes and local varieties in the genus to enable us to determine that. Hence the variety *A. pachista* becomes a dumping place for all *Amblypneustes* which have spinelets on the periproct and the height less than ·80 h.d., and a colouration unlike typical *ovum*. Practically all of the present lot lack locality labels, but a few are undoubtedly from Spencer or St. Vincent Gulf.

AMBLYPNEUSTES PALLIDUS.

Echinus pallidus Lamarck, Anim. s. Vert., iii, 1816, p. 48.
Amblypneustes pallidus Valenciennes, Voy. "Venus," Zooph., 1846, pl. ii, fig. 1.

There are sixty-nine specimens of this species, usually recognizable with ease, but thirty-nine are very small (2·5 mm. to 6 mm. h.d.). These little ones were dredged by Dr. Verco in St. Vincent and Spencer Gulfs, and are of no little interest because of their form and colour; all are relatively low (v.d. equalling ·52 to ·59 h.d.), which seems to indicate that the tendency to a spherical form so noticeable in *Amblypneustes* and *Holopneustes* is not at all a retention of a primitive condition, but is a recently acquired specialization. The colour of these young individuals is like that of the adults, either pale green or purple of some shade; twenty-two of the thirty-nine are predominantly green, eleven are predominantly purple (violet or deep lavender), and six are intermediate. In both adults and young the small spines are generally lavender, even when the primaries are purple or lavender, but occasionally they are pale green; primaries are usually unicolour, either green or purple, but occasionally they are green becoming violet at tip.

The adult specimens are all without locality labels, and twelve of them are bare tests. They do not show much diversity of form, for the lowest is 28 x 25 mm., and the highest is 48 x 50 mm.; v.d. is thus from ·90 to 1·04 h.d. In several large specimens the ambitus is distinctly above the equator, giving the test an egg-like form that is very noticeable.

HOLOPNEUSTES Agassiz & Desor.

HOLOPNEUSTES INFLATUS.

A. Agassiz, Bull. M.C.Z., iii, 1872, p. 56.

There are fourteen dry specimens of this species, of which nine are bare tests; none of the other five is fully covered with spines. In size they range from 17 x 15 mm. to 63 x 61 mm. In the largest specimen the ambulacra are 17 mm. wide, and the interambulacra are 21 mm., but in another individual with ambulacra 17 mm. wide, the interambulacra are only 18 mm. There is not a great deal of diversity in the form of the test, for it is notably high, even in the small specimens, and one 32 mm. in diameter is actually 34·5 mm. high, with the ambitus above the equator. In colouration there is considerable range, the tests being light greenish-grey, or bluish-grey, or dull reddish (with poriferous areas dull but light yellowish-green), or dull violet. The primary spines are usually violet of some shade, but they may be dull rose or pale red, or even dingy white. Apparently no two of the specimens are exactly alike. There are no locality labels for any of the specimens.

HOLOPNEUSTES POROSISSIMUS.

Agassiz & Desor, Ann. Sci. Nat. (3), vi, 1846, p. 364.

Only four of the sixteen dry specimens representing this species have a

locality label, and that reads "St. Vincent Gulf." These four are the smallest ones; three are still clothed with their brilliant red spines; the fourth and smallest is nearly bare, and measures 27 x 27 mm., but it is not spherical, for the oral surface is flattened and the ambitus is above the equator; in these specimens the test is dull grey-green, the small spines and the basal part of a few primaries green, and the dried tube-feet white in marked contrast.

Of the other specimens five are still more or less clothed with spines; the tests are dark grey, more or less strongly tinged with green; the small spines are green, greenish, or pale grey sometimes tipped with red; the primaries are more or less bright red, with the basal part often more or less green; as a rule the spines of the oral surface are most nearly completely red. One of these specimens is 75 mm. h.d., but only 56 mm. v.d.; it is thus unusually low, with v.d. only ·74 h.d. A second specimen, 75 mm. h.d., is 66 mm. high, while a specimen 69·5 mm. h.d. is 68 mm. high. One specimen is markedly conical, while several are nearly spherical. The bare tests call for little comment but one is 77 x 70 mm. The excess of width of the ambulacra over the interambulacra increases with age; in the small specimens we find the proportions, ambulacra 8·5 mm., interambulacra 8 mm., and amb. 11·5 mm. int. 10 mm.; in larger specimens, with amb. 21 mm. across, int. is 15 or 16 mm.; in the largest specimens amb. is 27 mm. to 28 mm., and int. is 20 mm.

FAMILY ECHINIDAE.

TRIPNEUSTES Agassiz.

TRIPNEUSTES GRATILLA.

Echinus gratilla Linné, Sys. Nat., ed. X, 1758, p. 664.
Tripneustes gratilla Lovén, Bih. Svensk. Vet-Akad. Handl., xiii, 1888, p. 77.

A single, bare test, 120 x 68 mm., labelled "East Australia," is the only representative of this species in the collection.

FAMILY STRONGYLOCENTROTIDAE.

PACHYCENTROTUS H. L. Clark.

PACHYCENTROTUS AUSTRALIAE.

Sphaerechinus australiae A. Agassiz, Bull. M.C.Z., iii, 1872, p. 55.
Pachycentrotus australiae H. L. Clark, Mem. M.C.Z., xxxiv, 1912, p. 349.

A very nice series of this little-known sea-urchin contains eighteen specimens, ranging from 11 x 6 mm. to 38 x 24 mm.; there are five bare tests, but the remaining thirteen specimens are in fine condition. The largest individual

is from the north Coast of Kangaroo Island, the others are all from either St. Vincent or Spencer Gulf. In the smallest specimen ocular I is fully insert, but ocular V is barely so. In all the others both I and V are fully insert, and in two cases (individuals 33 mm. and 35 mm. in diameter) ocular II is also insert. It seems probable that having I, V, II insert is the normal progressive variation for *Pachycentrotus*, but it is not frequent enough to make it the species character for *australiae*.

In the matter of colouration there is a most interesting parallelism between the sea-urchin and the quite unrelated *Amblypneustes pallidus*, for just as in that species, some individuals are wholly green, others are wholly purple or violet, and others are partly green and partly violet. At one extreme in *P. australiae* we have specimens with the test grey above, becoming whitish orally, more or less markedly shaded with violet, primary spines bright violet, darkest at base, white-tipped, with one or more narrow rings of a darker violet faintly indicated or sometimes well marked, and small spines wholly white or white with a violet base; there is no green indicated anywhere. At the other extreme are specimens with the test greyish green, primary spines dull green, darkest at base, white-tipped, with one or more narrow rings of a dusky green faintly indicated or sometimes well marked, and small spines whitish, more or less green at base, and usually tinged with greenish; the only traces of violet are on the basal part of some small spines near the mouth. In both violet and green specimens the tubercles and the plates on the buccal membrane are white. Most specimens are intermediate between these two extremes; often the primary spines are more or less violet, with the basal part dull green, the tip white, and the encircling rings dark violet, dusky, or greenish; violet tends to be more in evidence orally and green aborally. In some specimens the predominating tone is brown, with a more or less evident greenish tinge, and some small individuals look quite brown and white; such specimens, however, when critically examined show traces of either violet or green, or both.

This is one of the most distinctive sea-urchins endemic on the southern coast of Australia, and it is a pleasure to note that it is apparently rather common in St. Vincent Gulf.

HELIOCIDARIS Agassiz & Desor.

HELIOCIDARIS ERYTHROGRAMMA.

Echinus erythrogrammus Valenciennes, Voy. "Venus," Zooph., 1846, pl. vii, fig. 1.

Heliocidaris erythrogramma Agassiz & Desor, Ann. Sci. Nat., (3) vi, 1846, p. 371.

This common species is represented by forty-three specimens, of which thirty-five are bare tests. The smallest are 2·75 mm. to 3 mm. in diameter, with seven coronal plates in a series, and the diameter of the peristome is considerably over half the test diameter. The largest is almost twenty-nine times as large (h.d. = 79 mm.), but it has only seventeen or eighteen coronal plates in a series, and the diameter of the peristome is only 24 mm., less than one-third h.d. Some smaller specimens have twenty coronal plates in a column, and the peristome but little more than one-fourth h.d. As for colour, we find the tendency to be either violet or green that *Pachycentrotus* and *Amblypneustes pallidus* show, but most specimens that are predominantly green have the basal portion of the spines more or less extensively violet or at least livid with a hint of purple.

One specimen, 67 mm. in diameter, is labelled *H. armigera*, and is certainly suggestive of that form; the primaries are only 20 mm. to 25 mm. long, but as they are less than 2 mm. in diameter they are not stout enough for *H. armigera*, which, however, is probably not a valid species, but only an extreme form of *H. erythrogramma*.

While many of the specimens are without labels, the following localities are represented in the present series: Wallaroo Bay, 15 fathoms; Investigator Strait, 14 fathoms; St. Vincent Gulf; "south-east coast of Australia"; "Outer Harbour," St. Vincent Gulf.

FAMILY ECHINOMETRIDAE.

PARASALENIA A. Agassiz.

PARASALENIA PÖHLII

Pfeffer, Verhandl. Ver. Naturw. Unterh. Hamburg, vi, 1887, p. 110.

With the specimen of *Echinometra mathaei*, from Cairns, Queensland, there was a test of a *Parasalenia*, which is better referred to this species than to *P. gratiosa*, for there are no tubercles on the abactinal system, and the spines left around the peristome are pale violet with faint dusky bands. But genital three is not shut out from the periproct, and there is no red in the colouration. The abactinal system is greenish, but each genital plate is purple at the centre. The test is 16 mm. long, 13 mm. wide, and 7 mm. high. The colour of the test is nearly white, with some green next to the genital plates; the larger tubercles are pale lavender. There are five subequal anal plates, each one opposite an ocular. It is not altogether unlikely that this peculiar *Parasalenia* represents an undescribed species.

ECHINOMETRA Gray.

ECHINOMETRA MATHAEI.

Echinus mathaei de Blainville, Dict. Sci. Nat., xxxvii, 1825, p. 94.
Echinometra mathaei de Blainville, Dict. Sci. Nat., lx, 1830, p. 206.

There is a single small specimen of this common sea-urchin from Cairns, Queensland. The primary spines are pale olive at base, becoming darker distally and then abruptly white-tipped. The species belongs, as does *Parasalenia*, in the North Australian fauna.

HETEROCENTROTUS Brandt.

HETEROCENTROTUS MAMMILLATUS.

Echinus mammillatus Linné, Sys. Nat., ed. X, 1758, p. 667.
Heterocentrotus mammillatus Brandt, Prod. desc. Anim., 1835, p. 266.

There is a single small but handsome specimen from north-east Australia. The primary spines are short and very stout, with two broad but ill-defined white bands near tip; the ground colour is light grey-brown or fawn-colour, becoming dark brown distally, though the actual tip is brownish-yellow; a typical spine is 60 mm. long, 6 mm. thick at base, and 12 mm. near tip; orally the primaries are flattened and broadly tipped with orange-red or brownish-orange; secondaries deep chocolate-brown.

ORDER EXOCYCLOIDA

SUB-ORDER CLYPEASTRINA

FAMILY ARACHNOIDIDAE.

ARACHNOIDES Leske.

ARACHNOIDES PLACENTA.

Echinus placenta Linné, Sys. Nat., ed. X, 1758, p. 666.
Arachnoides placenta Agassiz, Mon. Ech. Mon. Scut., 1841, p. 94.

There are five specimens of this well-known "sand-dollar," of which one, 34 x 34 mm., and water-worn, is from an unknown locality, while four are from Townsville, Queensland, "presented by Clement L. Wragge, August 5, 1886." These are all small specimens, 35 mm. to 48 mm. across; the largest is bare and broken.

AMMOTROPHUS (53) gen. nov.

Test discoidal, its height less than ·15 of its diameter. Ambulacra wider than interambulacra at margin of test. Petals short, wide; poriferous areas divergent, the outer margin rounded, so that they appear curved inward at tip. Genital pores four. Periproct rather large, on oral surface, some distance from margin. Peristomal membrane heavily plated. Auricles entirely distinct, much more widely separated than in *Arachnoides*. Pedicellariae with three valves.

Genotype: *Ammotrophus cyclius* sp. nov. *(vide infra)*.

There is no doubt that this is the most interesting new genus of Echinoderms that has been discovered for some time, since it is not only so well characterized, but is obviously a member of a family which has always consisted of but a single genus. The character of the auricles, the plated buccal membrane, the four genital pores, the form of the test, and the character of the ambulacra leave no room for questioning the relationship to *Arachnoides*, while the form and position of the periproct, the pedicellariae, and certain details of the petaloid area serve to separate it well from that genus. It is noteworthy that the new genus is South Australian, while *Arachnoides* occurs from New Zealand and the north-eastern coast of Australia northward to the Malay Peninsula.

AMMOTROPHUS CYCLIUS (54) sp. nov.

Test 54 mm. long, 54 mm. wide, and 7·5 mm. high, but the outline is not perfectly circular, for there is a slight indentation at the margin in each ambulacrum, and also in the posterior interradius; if measured through II–4 or IV–1, the diameter is only 53 mm. Petals approximately 15 mm. long by 8·5 mm. wide near the widely open tip; II and IV are a trifle longer than I and V, and III is, by an insignificant margin, the largest of all; there are about forty pore-pairs on a side in III. Abactinal system small, with the four genital pores close together. Ambulacral furrows conspicuous and very straight. Peristome irregularly circular, less than 3 mm. in diameter, the membrane filled with narrow, thick, curved plates; centre of peristome is 27 mm. from anterior margin of test. Periproct, 3·25 mm. long, 2·5 mm. wide, its membrane heavily plated, its centre 7 mm. from posterior margin of test.

Test covered with a dense coat of small spines, like those of *Arachnoides*, but not nearly so diversified; those of the dorsal side are relatively short (about 1 millimetre long), with the distal end swollen, slightly curved, and more or less

(53) ἀμμότροφος=growing in sand, in reference to the habit indicated by the very flat test.

(54) κύκλιος=circular, in reference to the ambital outline.

asymmetrical, one side being often flattened to some degree; on the oral side the spines are longer, especially about peristome and periproct, not swollen at tip, but generally blunt, though near test-margin they may be pointed; they are usually curved, but may be perfectly straight; there is no essential difference between those of different areas, except in size, the largest being near the margin in the interambulacra, the smallest along the sides of the ambulacral furrows; the latter do not in any sense "roof over" the furrows.

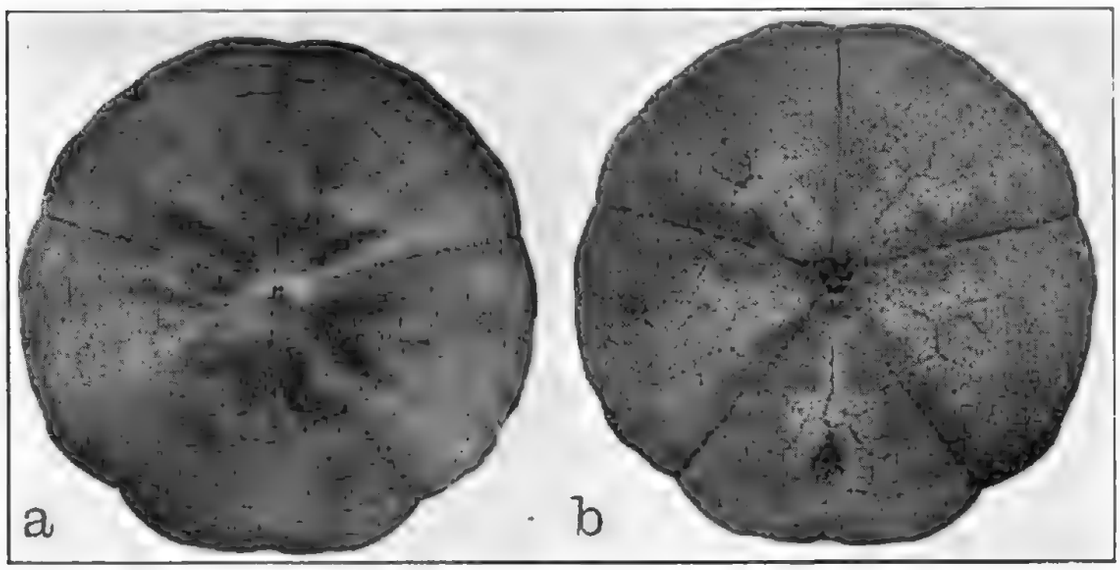


Fig. 140. *Ammotrophus cyclius*; a, aboral view; b, oral view of paratype (nat. size).

Pedicellariae so small, so few, and so hard to find that they can be of little service as a species character, but they are of great interest because so entirely different from those of *Arachnoides*. After prolonged search, I found six, of which one may be called triphyllous and the others tridentate; but the tridentate are of two quite distinct sorts. All the pedicellariae seen had three valves. The triphyllous had valves scarcely ·10 mm. long, with blades nearly straight, narrow, with nearly parallel sides, ending in a conspicuous sharp, inwardly curved, unpaired tooth. The tridentate have the heads about as long as the stalks, but only about ·20 mm. in length; the largest was about ·25 mm.; in one form the head is stout, long pyramidal, blunt, with valves somewhat flattened on the back, especially basally, and closely appressed to each other, along the finely serrate margins throughout their entire length; in the other form the heads are also stout and about ·20 mm. in length, but the valves are somewhat curved, and meet only for about the distal third; they thus resemble somewhat the tridentate pedicellariae of some Clypeasters; both kinds of tridentates in *Ammotrophus* thus seem to be of a relatively generalized type.

Colour of all the specimens, whether dry or alcoholic, is a rather bright yellow-brown, sometimes with a more or less evident reddish tinge.

Holotype: Reg. No. E. 644.

There are eighty-four specimens of this interesting sand-dollar, some of which had been identified as "*Echinarachnius parma*" and some as "*Peronella decagonalis*"; there is an obvious resemblance to *Echinarachnius*, and it is possible that the records of that genus from Australia are based upon specimens of *Ammotrophus*. Most of the specimens before me are from Encounter Bay, but a considerable number were dredged by Dr. Verco in St. Vincent and Spencer Gulfs. There is remarkable uniformity in the shape and proportions of the test; the smallest is 15 x 15 mm., with a height of less than 2 mm., while the largest is 59 x 59 x 8·5 mm. The indentations in the margin in the posterior interradius and in the ambulacra are about equally evident in young and old, but the smallest specimens have the periproct relatively nearer the margin than do the adults. Genital pores are not usually present until the individuals are nearly 30 mm. in diameter. The alimentary canal runs forward in ambulacrum III for a short distance (about to the end of the petal), then passes to the left into interambulacrum three, and runs around the body, in the vicinity of the petal tips on the left-hand side, but distal to them on the right-hand side, to the right-hand margin of III, where it bends abruptly inward, and then runs backward under the petal tips in II and I to V, where it bends outward, and passing over the outer loop joins the periproct. Its course is easily traced, through the test, in young, alcoholic specimens.

Examination of a perfectly clean bare test shows that the ambulacral furrows of the oral surface extend up over the margin, and run almost to the apical system, diminishing rapidly after they enter the petals, just as in *Arachnoides*, but quite different from any of the *Scutellidae*. The ambulacra at test-margin are about twice as wide as the interambulacra; ambulacra I and V are 23 mm. wide, in a test 50 mm. in diameter, the others 19 mm. to 20 mm.; interambulacra 1 and 4 are 9 mm. wide, the others 10 mm. to 11 mm. The primordial interambulacral plates are all in place around the peristome, as in *Arachnoides*, but just as in that genus the second series of ambulacral plates form a closed ring, separating the other interambulacral plates from the basicoronal series. The succeeding ambulacral plates are much smaller and widely separated interradially, so that there are three pairs of interambulacral plates in each interambulacrum on the oral side of the test; occasionally there are only two pairs in addition to the marginal plates, but much more commonly so much of the marginal plates is visible orally that we might say there are four pairs of oral interambulacral plates. This condition is interesting, because in *Arachnoides placenta* there is only one such pair, and in *A. zelandiae* there are two

(sometimes three), so that *Ammotrophus* is apparently less specialized than *Arachnoides*. At the other end of the interambulacrum, where it touches the apical system, the plates are very small and more or less coalesced, so that it is almost impossible to make out the sutures, but in young specimens they are detectable, and it is certain there is not a single adapical plate, as in the *Laganidae*.

Examination of the interior of the test shows that the oral and aboral surfaces are quite separate to the very margin, but the outer third of the interior space is well filled by concentric circles of calcareous pillars, which may coalesce more or less laterally. In each ambulacrum, just at the end of the petals, are two stouter sets of such pillars, also more or less coalesced, and in the interradii (on the large ambulacral plates of the second series) are still larger pillars, the innermost of which are just back of the auricles. The ambulacral plates of the basicoronal series, on which the auricles stand, may or may not be in contact to some extent at the peristomal margin of the interior of the test; in other words, the primordial interambulacral plates, which are fairly wide on the outer surface of the test, have bevelled lateral margins, and their inner surface may be so reduced proximally that they no longer separate the ambulacral plates there.

AMMOTROPHUS PLATYTERUS (55) sp. nov.

Test 27 mm. long, 29·5 mm. wide, and 3·5 mm. high. Petals about 6 mm. long, nearly 5 mm. wide, with about thirty pore-pairs on each side; III is slightly the largest, II and IV the narrowest. Abactinal system very small, with four genital pores, the posterior pair much further apart than the anterior. Ambulacral furrows very well marked, except in III, where it is rather indistinct; the furrows run up on to the aboral side, as in *A. cyclius*; furrows II and IV are nearly straight, with only a slight curve near peristome, but furrows I and V are much curved; they run out from the peristome at nearly a right angle to the median line, and then bend downwards to the margin. Peristome posterior, 2·5 mm. long, 2 mm. wide; its centre is only 12 mm. from posterior margin of test. Periproct rounded diamond-shape, about as long as wide, 1·75 mm. in diameter; its centre is 3·5 mm. from posterior margin of test. In arrangement of plates in test and proportions of ambulacra and interambulacra, not essentially different from *A. cyclius*. Test perfectly bare, white.

Holotype: Reg. No. E. 645.

There is but a single specimen of this species from St. Vincent Gulf. It is superficially quite different from *A. cyclius*, and probably represents a distinct

(55) πλατύτερος=broader, in reference to the shape of the test as compared with *A. cyclius*.

species, but it is possible that it is only a "freak" *A. cyclius*. It is even possible that with larger series of *A. cyclius* available greater diversity in test-form will be discovered, and this specimen will prove to be only an unusually wide individual of the common species. It seems better to treat it as a distinct species until more abundant material determines its true status.

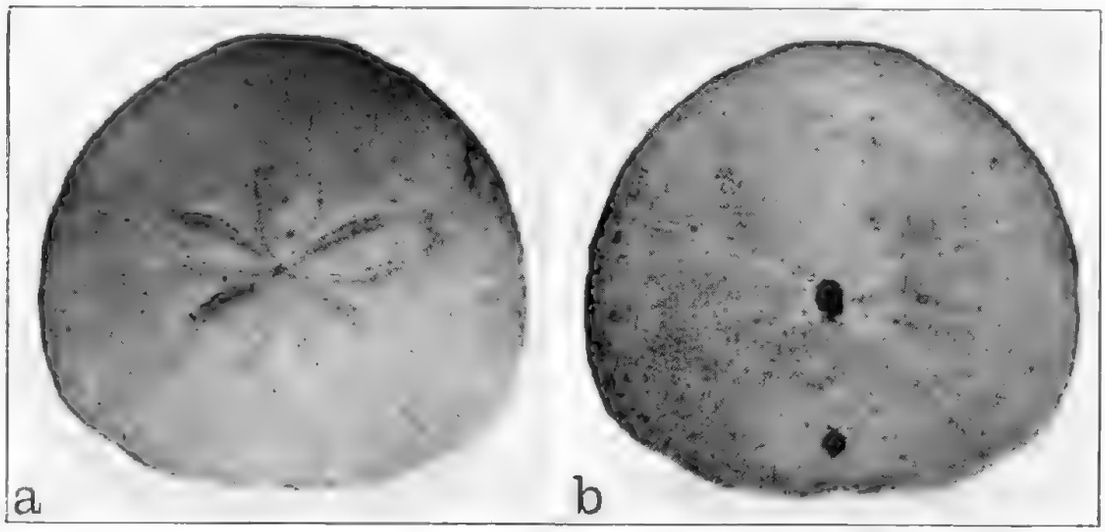


Fig. 141. *Mammotrophus platyterus;* a, aboral view; b, oral view of holotype (x 2).

FAMILY LAGANIDAE.

PERONELLA Gray.

PERONELLA LESUEURI.

Laganum lesueuri Agassiz, Mon. Ech.: Mon. Scut., 1841, p. 116.
Peronella lesueuri A. Agassiz, Rev. Ech., pt. 1, 1872, p. 148.

There is only a single, bare test, 112 mm. long by 110 mm. wide, from an unknown locality.

PERONELLA PERONII.

Laganum peronii Agassiz, Mon. Ech.: Mon. Scut., 1841, p. 123.
Laganum (Peronella) peronii Gray, Cat. Rec. Ech. Brit. Mus., 1855, p. 13.
Peronella peronii A. Agassiz, Rev. Ech. pt. 1, 1872, p. 149.

Although there are 132 specimens of this characteristically Australian species in the collection, not a quarter of them have their normal coat of spines and more than two-thirds are dead, bare tests, often damaged. Specimens, living when taken, are from Dr. Verco's collections in Spencer and St. Vincent Gulfs, but there are dead tests from the following localities, most of which were

dredged by Dr. Verco: Off Beachport, 110–200 fathoms: Kangaroo Island, off Cape Borda, 62 fathoms; K.I., off Point Marsden, 17 fathoms; K.I., off American River, 8 fathoms; off Yankalilla Bay, 20 fathoms; 35 miles south-west of Neptune Island, Investigator Strait, 104 fathoms; Backstairs Passage, 20–22 fathoms; off Cape Jaffa, 90 fathoms; 60 miles west of Eucla, Great Australian Bight.

The specimens range in size from less than 2 mm. in length to something over 22 mm. Genital pores are evident in some specimens 12 mm. long, but there is great individual diversity in this matter; in one specimen 6 mm. long the four genital pores are conspicuous while in another almost 12 mm. long there are none visible. Madreporic pores usually begin to appear when the test is 5–6 mm. long, but they are never very numerous or conspicuous, and the oculo-genital mass (the apical system) is more completely obscured than in any other echinoid I have examined.

FAMILY FIBULARIIDAE.

ECHINOCYAMUS Leske.

ECHINOCYAMUS PLATYTATUS.

H. L. Clark, Mem. M.C.Z., xlvi, 1914, p. 63.

Although there are 168 specimens of this species at hand, not one was alive when taken so far as can be told from present appearances; only four show any spines at all and in these, the indications are that the tests were dead and the spines were falling off when they were dredged. The largest specimen is 9·5 x 8 mm., while the smallest are about 2 mm. long. There is great variation in form, some individuals being as wide as long and practically circular in outline while others are only three-fourths as wide as long, and the anterior end is narrower and bluntly pointed. The height ranges from about ·23 of length to over ·32, but usually it is well under ·30. There is great diversity also in the matter of the genital pores, which may be very large or moderate or small; there is no correlation between the size of the test and the size of the pores; some very small specimens have big pores and some of the largest specimens have small pores; there is probably a sex correlation but that is at present a pure assumption. There are normally four pores but it is not uncommon to find but three and one individual, nearly 6 mm. long, has but two, one in interradius 1 and one in 3; they are relatively very large.

This large series of specimens is from the following localities: Off Cape Jaffa, 130 fathoms; off Beachport, 110–200 fathoms; Backstairs Passage, 17–22 fathoms; off St. Francis Island, 15–20 fathoms; St. Vincent Gulf; King George's Sound, 12–25 fathoms; beach at Hopetown, West Australia. Practically all the specimens were collected by Dr. Verco.

FIBULARIA Lamarck.

FIBULARIA CRANIOLARIS.

Echinocyamus craniolaris Leske, Add. ad Klein, 1778, p. 150.
Fibularia craniolaris de Blainville, Dict. Sci. Nat., xvi. 1820, p. 512.

There are 305 fibularias, which I am including under this name but their diversity of form is very great, as is also the diversity of size. They were taken at the following places, chiefly by Dr. Verco: Yankalilla Bay, 20 fathoms; Investigator Strait, 20 fathoms; Backstairs Passage, 17–22 fathoms; off Point Marsden, Kangaroo Island; off Cape Marsden, 17 fathoms; St. Vincent Gulf; east of North Neptune, 45 fathoms; Spencer and St. Vincent Gulfs; King George's Sound, 12–25 fathoms. Only nine or ten still carry their spines.

The smallest are about 2·5 mm. long and less than 2 mm. wide, only moderately well-arched, and with bluntly pointed ends, especially anteriorly. Larger specimens show an increasing variety of form and the large ones are often strikingly unlike; thus one specimen is 9 mm. long, almost 8 mm. wide and 7 mm. high, while another is 11·5 mm. long, almost 8 mm. wide and 6·5 mm. high. some individuals are somewhat flattened dorsally while others tend to be conspicuously elevated in ambulacrum III in front of the apical system. In spite of this diversity of shape there is such complete agreement in the small periproct placed close behind the peristome, the small genital pores and the large ambulacral pores, forming short petals with few pore-pairs, that I do not hesitate to call all of the specimens *F. craniolaris*.

FIBULARIA PLATEIA ([56]) sp. nov.

Test 6·25 mm. long, 4·8 mm. wide and 2·35 mm. high, somewhat higher anteriorly than posteriorly. Petaloid area about 3·25 mm. long by 2·5 mm. wide; pores of petals big, as large as genital pores, two very oblique pairs on each side of each petal but in petal IV, the two pairs in the anterior area each lacks one pore so there are but six pores in petal; in petal II one of posterior pairs lacks a pore so there are but seven pores in petal; there are thus thirty-seven pores in the whole petaloid area instead of the forty that there should be. Genital pores four, large. Ocular pores not detectable. Madreporic pore single. Peristome 1·25 mm. in diameter, its centre 3 mm. from posterior margin of test. Periproct ·80 mm. in diameter, its centre 1·25 mm. from posterior margin of test; the piece of test between peristome and periproct is thus only a trifle over half a millimeter wide. Test perfectly bare, whitish.

Holotype: Reg. No. E. 650.

([56]) πλατεῖα = flat, in reference to the low Echinocyamus-like test.

The holotype is the only adult individual among the 159 specimens of *Fibularia* that I am referring to this species. The others range from less than two to a little over four mm. in length. There is not much diversity in the shape of the test which is always flattened but there is much diversity in the number of pores in the petaloid area, ranging from thirty-one to thirty-nine in the larger specimens and being much fewer than thirty in the small ones. The genital pores are often much larger than the ambulacral pores. There is no trace of dividing

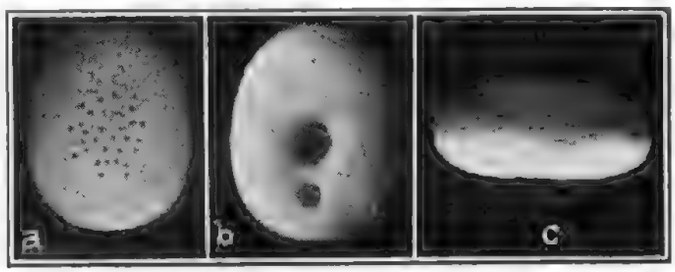


Fig. 142. *Fibularia plateia*; a, aboral view; b, oral view; c, side view of holotype (x 4).

partitions in the interior of the test, the species being a true Fibularia in spite of its flattened test. It is nearest, perhaps, to the East Indian species *F. cribellum* but the differences in the form of the test and in the petaloid areas seem to me too great to permit considering them identical. But I have never seen *F. cribellum* and it may be comparison of specimens will show that I am wrong in making a new species of the South Australian form. Nearly all of this large series of *F. plateia* we owe to Dr. Verco. They were taken at the following places and it will be noticed that this *Fibularia* occurs, apparently, with *F. craniolaris* and *Echinocyamus platylatus*: Off Beachport, 40–110 fathoms; Backstairs Passage, 17–22 fathoms; seven miles south-west of Newland Head, outside Backstairs Passage, 20 fathoms; Wallaroo Bay, 15 fathoms; St. Vincent Gulf; off St. Francis Island, 15–20 fathoms; off Cape Borda, 55 fathoms; off Cape Jaffa, 130 fathoms; east of North Neptune Island, 45 fathoms; off Bunbury, West Australia, 22 fathoms. All the specimens are bare, dead tests.

SUB-ORDER NUCLEOLITINA

FAMILY NUCLEOLITIDAE.

APATOPYGUS Hawkins.

APATOPYGUS RECENS.

Nucleolites recens Milne-Edwards, Cuvier's Reg. Anim.; Zoophytes, 1836, pl. xiv, fig. 3.

Apatopygus recens Hawkins, Geol. Mag., lvii, 1920, p. 396.

One of the most interesting specimens in the collection is a young *Apatopygus* taken by Dr. Verco in 22 fathoms off Bunbury, West Australia. The specimen is 10 mm. long, 8 mm. wide and 4 mm. high, and is covered with a complete coat of spines and pedicellariae, showing that it was living when taken. The genus is known at present only from New Zealand, though it has been recorded also from Madagascar. This specimen which is undoubtedly from West Australia makes the Madagascar record more credible. I have no specimen from New Zealand small enough to make a satisfactory comparison with the present specimen possible but fortunately Mortensen ([57]) has given so full and clear an account of the New Zealand species (*A. recens*) that it is not difficult to see wherein the West Australian resembles or differs from it. The resemblances are many, the differences few and trivial. The only difference that is worth mentioning is in the pedicellariae which are fairly abundant and in general correspond to Mortensen's description and figures. There are about fifty globiferous pedicellariae present chiefly along the sides of the test and as the glandular tissue on the heads of these has dried black (or nearly so), each pedicellaria appears as a black spot among the pale yellowish spines. The valves of these pedicellariae are not exactly like those of the New Zealand form, as the blade is a little longer, more constricted and has but four terminal teeth. The tridentate pedicellariae also show some slight differences due to the greater thickness of the basal part: the valves seem to be distinctly wider basally. Although these differences seem trivial, they at least suggest the possibility that the West Australian *Apatopygus* is not identical with the New Zealand species but represents a new species. In view however of the scantiness and youthfulness of the material, it is best to call it *A. recens* until abundant material shall solve the problem.

SUB-ORDER SPATANGINA

FAMILY HEMIASTERIDAE.

PROTENASTER Pomel.

PROTENASTER AUSTRALIS.

Desoria australis Gray, Ann. Mag. Nat. Hist. (2), vii, 1851, p. 132.
Protenaster australis Pomel, Class. Meth. Ech., 1883, p. 36.

A small, bare test, 21 mm. long, 18 mm. wide, and 13 mm. high, of this species is of interest because of its locality. It bears the label: "Collected on beach at Ellensbrook, w. coast of W. Australia, south of Cape Naturaliste. Dr. Verco."

([57]) Mortensen, Vid. Med., lxxiii, 1921, pp. 184-192, pl. viii.

FAMILY SPATANGIDAE.

GONIMARETIA H. L. Clark.

GONIMARETIA INTERRUPTA.

Lonchophorus interruptus Studer, Monatsb. Berlin Acad. Wiss., 1880, p. 880.
Gonimaretia interrupta H. L. Clark, Mem. M.C.Z., xlvi, 1917, p. 245.

A specimen of this rare species is in the collection, but has no locality label. The only specimen previously known is the unique holotype in Berlin, which was taken in "30 fathoms, West Australia." Presumably, therefore, the present specimen is from the western coast of the continent. It is 26 mm. long, 22 mm. wide, and 12 mm. high; the abactinal system is only 11 mm. from the anterior end, and the test is highest there. In side view, therefore, the form of the test looks very different from that of *G. tylota*, the most nearly allied species of *Gonimaretia*. The specimen is an interesting non-pentamerous variant, as there is no petal in ambulacrum I; ocular I seems to be absent, and ambulacrum I ends just above the ambitus in the zone where the petal, if present, would begin. Interambulacra 1 and 5 are both present, clear to the apical disk, but column 2 of area 5 just fails to reach the disk. Petals II, IV, and V are each about 8 mm. long. The specimen is pentamerous ventrally. It belongs in Jackson's Group 16, and is discussed by that author in his recent memoir ([58]).

The pedicellariae of this species have never been described, so it is of interest to compare them with those of *G. tylota*. Globiferous pedicellariae are common on the ambulacra orally, as in *G. tylota*, but they are conspicuously different, for the valves are much shorter and less slender, and the tips are not coloured; in the present specimen the valves are nearly or quite closed, not spread wide open, as in the specimen of *G. tylota* examined, but this is, of course, a matter of preservation, or at least of physiological condition. Tridentate pedicellariae are all of the narrow-valved type of *G. tylota;* none resembling a rostrate type were seen; the valves are shorter and broader than in *G. tylota*, but are not very distinctive. Ophicephalous pedicellariae of normal form are present, but seem to be rare; no triphyllous pedicellariae were seen.

In only one respect does this specimen differ essentially from Studer's original description and figures, and that is in the presence of primary spines on the aboral surface. Studer's specimen seemed to have none, but in the present individual there are four in interambulacrum 2, near the apical system, close to the boundary of ambulacrum II, and two, or perhaps three, in the same relative position in interambulacrum 3. These primaries are not so large as in *G. tylota*, and their position is entirely different from those of that species.

([58]) Mem. Boston Soc. Nat. Hist., viii, 1927, p. 536.

There can be no doubt that the species is a typical *Gonimaretia*, and it is a great pity that we have no information as to when and where the present specimen was taken.

BREYNIA Agassiz & Desor.

BREYNIA AUSTRALASIAE.

Spatangus australasiae Leach, Zool. Misc., ii, 1815, p. 68.
Breynia australasiae Gray, Cat. Rec. Ech. Brit. Mus., 1855, p. 46.

There are seven bare tests of this common Australian spatangoid, of which four are from Port Essington, Northern Territory, and the others are without labels. The smallest specimen is 45 mm. long, 39 mm. wide, and 28 mm. high; the largest is 75 x 62 x 38 mm.

ECHINOCARDIUM Gray.

ECHINOCARDIUM CORDATUM.

Echinus cordatus Pennant, Brit. Zool., iv, 1777, p. 69.
Echinocardium cordatus Gray, Brit. Rad., 1848, p. 6.

There are eighty-eight specimens of this cosmopolitan species, but the great majority are small and of little interest. Those which have locality labels were collected at the following places: Off American River, Kangaroo Island; Port Willunga, S.A., A. Zietz coll.; Warooka, Yorke Peninsula; off Yankalilla Bay, 20 fathoms; St. Francis Island, 15–20 fathoms; St. Vincent and Spencer Gulfs, Verco collection. The specimen from Warooka is a bare test, 53 mm. long, 48 mm. wide, and 33 mm. high, while that from American River, which is completely bleached and considerably broken, is 57 x 52 x 37 mm. These two specimens are considerably larger than any non-European individuals of this species that have been recorded. On comparing them with European specimens of similar size I was at once struck by three differences, and for a time I thought I had found tangible characters by which to distinguish *E. australe* as a species distinct from *E. cordatum*. The three points were first the size and width of the area comprised within the internal fasciole; second, the number of pore-pairs enclosed within the subanal fasciole; and third, the form of the periproct. The South Australian specimens have the area within the internal fasciole relatively small and narrow; the specimens with which I first compared them have it large and notably broad. The Australian specimens have four pore-pairs on each side of the subanal plastron, the European specimens only three. The Australian specimens have the periproct as wide as high, the European specimens have it much higher than wide. But further comparison of specimens convinced me that individual diversity is so great in the form and size of both internal

fasciole and periproct that those characters cannot be relied on. There is also intergradation in the number of subanal tube-feet, but here the difference between the northern and southern forms is worth noting. Many, perhaps most, Australian specimens over 25 mm. long, have four such tube-feet, and in one specimen there are five on each side. In European specimens I have only found one which had four, and occasionally there are only two, as in young specimens from everywhere. Japanese specimens have only three, so far as my observations go. Of five New Zealand specimens two have two, two have three, and one has four. Evidently we cannot distinguish a species on so variable a character, but I have not sufficient material to enable me to decide whether we might not wisely recognize a southern variety or subspecies. However, it looks as though the Australian form was as different from that found in New Zealand waters as it is from the European species.

A NEW AND VERY LARGE CRIOCERATID AMMONOID FROM THE CRETACEOUS OF CENTRAL AUSTRALIA

BY PROFESSOR WALTER HOWCHIN AND DR. F. W. WHITEHOUSE

Summary

The South Australian Museum is indebted to Mounted Constable T. Jury, at one time stationed at Oodnadatta, for a very fine example of an ammonoid shell which he discovered in the Cretaceous argillaceous limestone of the interior of the continent. The specimen was found in the banks of the Arkeringa Creek, forty-eight miles south-westward of Oodnadatta, and situated on the north-eastern flanks of Stuart's Range, between Giddi-Giddinna Creek and Oolgelima Creek (Pastoral Plan, Sheet No. 14). See map in text (fig. 143).

A NEW AND VERY LARGE CRIOCERATID AMMONOID FROM THE CRETACEOUS OF CENTRAL AUSTRALIA

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Text figs. 143-145.

THE South Australian Museum is indebted to Mounted Constable T. Jury, at one time stationed at Oodnadatta, for a very fine example of an ammonoid shell which he discovered in the Cretaceous argillaceous limestone of the interior of the continent. The specimen was found in the banks of the Arkeringa Creek, forty-eight miles south-westward of Oodnadatta, and situated on the north-eastern flanks of Stuart's Range, between Giddi-Giddinna Creek and Oolgelima Creek (Pastoral Plan, Sheet No. 14). See map in text (fig. 143).

In the first instance Mr. Jury forwarded to Adelaide only a portion of the shell that had fallen free from the matrix. The specimen was of such evident scientific interest that under the courteous permission of the Commissioner of Police (Brigadier-General Leane), Mr. Jury was requested to obtain, if possible, the remainder of the fossil. This work was carefully executed, and with the exception of the primordial whorls, which were broken off prior to its entombment, the specimen is in perfect condition, and is the largest example, and one of the most complete, of its kind known.

REFERENCES TO THE LITERATURE OF THE AUSTRALIAN CRIOCERATIDS.

In 1867 Professor McCoy obtained a specimen from the head of the Flinders River, Queensland, which he named *Ancyloceras flindersi* (4). This very imperfectly known species is of enormous size. McCoy did not figure the holotype, the necessary figure being given in 1909 by Etheridge (18, pl. 39, fig. 1).

Crioceras australe was founded by Moore in 1869 (5, p. 257) on a specimen from Wallumbilla Creek, Queensland. The type specimen, which was very incomplete, was destroyed in the Sydney Garden Palace fire of September 22, 1882. Owing to the loss of the type, much confusion has arisen as to the interpretation of the species. One of us (Whitehouse, 21, p. 214) has lately chosen a neotype of the species, which was then referred tentatively to the genus *Tropaeum*.

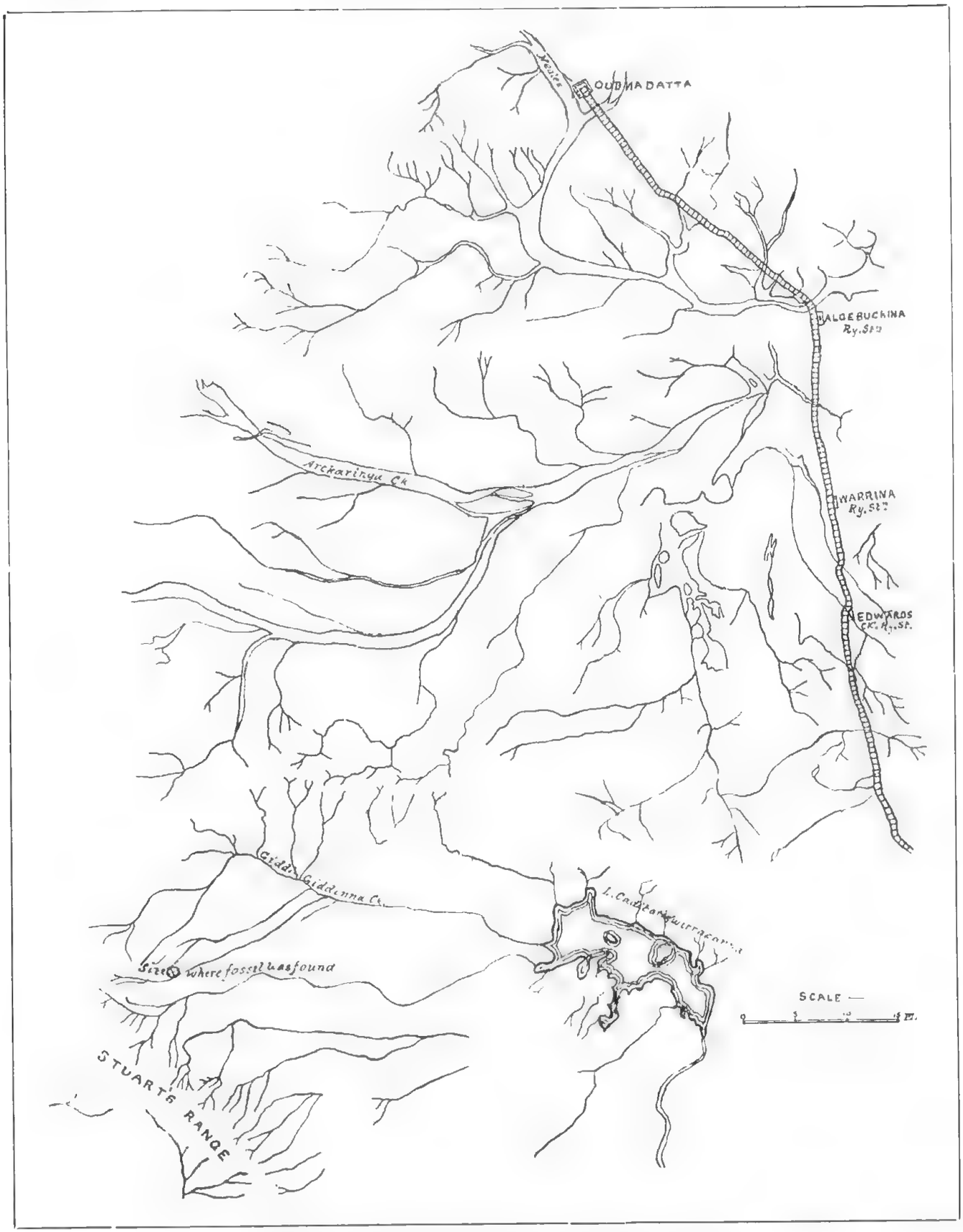

Fig. 143. Shows locality where the fossil was found.

In 1875 Waagen (6) recorded and figured from Kutch, in India, a portion of a large crioceratid as *Crioceras australe* Moore. This specimen has been examined by one of us (F.W.W.). Though belonging to the genus *Australiceras*, so typical of the Australian Aptian, it represents a species as yet unknown in Australia, and for which a new specific name is required.

The name *Crioceras jackii* was erected in 1880 by Etheridge (7) for a Walsh River (Queensland) specimen. This species was selected later by Whitehouse as the genotype of *Australiceras (v. inf.)*.

In 1883, Etheridge (8) recorded further crioceratid fragments from North-West Queensland.

In 1883, Tenison-Woods (9) gave the name *Crioceras irregulare* to a new form from the Palmer River (Queensland). The specific name was abandoned by Etheridge in 1892, but re-erected by Whitehouse in 1926, and placed in the genus *Australiceras*.

Ratte in 1886 published a note (10) on a large fragment referred by him to *Crioceras australe*. The specimen has not been examined by either of us; and from the figure it is not quite clear to which of the species, into which *Crioceras australe* has been split, this form belongs.

At the first meeting of the Australasian Association for the Advancement of Science (1887), the late Professor Ralph Tate (12) supplied a "List of Cretaceous fossils of the Lake Eyre Basin," in which *Crioceras australe* finds a place; but the author gives no particulars as to the locality where it was found or to the name of the discoverer. The specimen to which he referred is probably that presented to the Adelaide University by Mr. J. J. East, and mentioned by him in 1889 in a paper on the geology of Central Australia (13).

In 1892, Etheridge (14), in his revision of the fossil floras and faunas of Queensland, reviewed the Cretaceous ammonoids. He described and referred to the crioceratid species already named as *Ancyloceras flindersi* McCoy, *Crioceras australe* Moore, and *Crioceras* sp. ind. As new species were erected *Hamites* (?) *laqueus*, *Ancyloceras taylori*, and *Crioceras edkinsi*, the name *Crioceras jackii* Eth. fil. was abandoned, it being recorded in the synonymy of *Crioceras australe*. Many new locality records were given.

In the report of the Horn Expedition, 1896, Tate and Watt acknowledge the gift of "examples of *Crioceras australis*" from Charlotte Waters (15, p. 63), but no further notices of the specimens are available.

In two papers published in 1902 (16 and 17), Etheridge recorded the Cretaceous ammonites known from New South Wales and South Australia, but no additions were made to the species.

In 1905, Etheridge (18) took the opportunity, in describing a collection of fossils from Dalhousie Springs, to add still further notes on the Australian

crioceratids. *Crioceras australe* Moore, *C. jackii* Eth. fil., and *C. irregulare* Tenison-Woods were regarded as identical and placed under the name *C. australe*. Further record was made of *Crioceras (Ancyloceras) flindersi*, and a new species, *Ancyloceras cordycepoides* was erected. *Anisoceras* (?) sp. was recorded.

Etheridge's main revision (20) of the crioceratids appeared in 1909. In this very important and magnificently illustrated paper a vast wealth of material was described. At that time confusion existed in all countries on the relation of the loosely coiled ammonoids. Etheridge saw that the accepted classifications were unsatisfactory, and, in placing the species in such accepted genera, saw that future generic revision would be needed. He described and figured the following species: *Crioceras* (?) *leptus; Crioceras* sp. nov.; *C.* sp.; *C. jackii* Eth. fil. (synonym: *C. irregulare* Tenison-Woods); *C. nautiloides* sp. nov.; *C. axonoides* sp. nov.; *C. ammonoides* sp. nov.; *C. plectoides* sp. nov.; *C. flindersi* McCoy sp.; *C. lampros* sp. nov.; *C. cordycepoides* Eth. fil.; *C. laqueus* Eth. fil.; *C. taylori* Eth. fil. sp.; *C.* (?) sp.; and *Leptoceras* (?) *edkinsi* Eth. fil. sp.

The name *Crioceras australe* was abandoned.

In 1926 Whitehouse revised the whole of the ammonoid faunas of Eastern Australia. A number of new species were erected, and all names previously bestowed were retained, "*Crioceras*" *australe* Moore and "*C.*" *irregulare* Tenison-Woods being reinstituted. The Australian species were placed in the genera *Australiceras**, *Tropaeum*, *Toxoceratoides*, *Hamites*, *Labeceras**, *Appurdiceras**, *Anisoceras*, *Aleteceras**, *Myloceras** and *Flindersites**, the genera marked with an asterisk being new. Of these *Australiceras*, *Tropaeum* and *Toxoceratoides* belong to the Roma Series, the remaining genera coming from the Tambo Series. (In this paper the old "Rolling Downs formation" was divided into three series: The Morven Bed, the Roma Series, and the Tambo Series in ascending order.)

FAMILY ANCYLOCERATIDAE HYATT (EMEND WHITEHOUSE).

This family includes the lineage *Ancyloceras*, *Australiceras*, *Tropaeum*, and *Ammonitoceras*. *Australiceras*, which has trituberculation on the initial and final stages of the shell, but not on the intermediate stages, passes to *Tropaeum* by the complete loss of tubercles. On the specimen described below weak tubercles are faintly suggested on the final stage (the coarse costae of the body-chamber), but the initial whorls are not preserved. It is advisable, however, to retain the species in *Tropaeum* rather than in *Australiceras*.

TROPAEUM IMPERATOR sp. nov.

Fig. 144.

Coiling crioceratid; earliest whorls unknown, later whorls simply costate; while the costae of the body-chamber are coarse, widely spaced, and have *very* faint tri-tuberculation, in the intermediate stages the costae are reclined, slightly flexed, and number about 75 to 80 per whorl; the costae, which occasionally

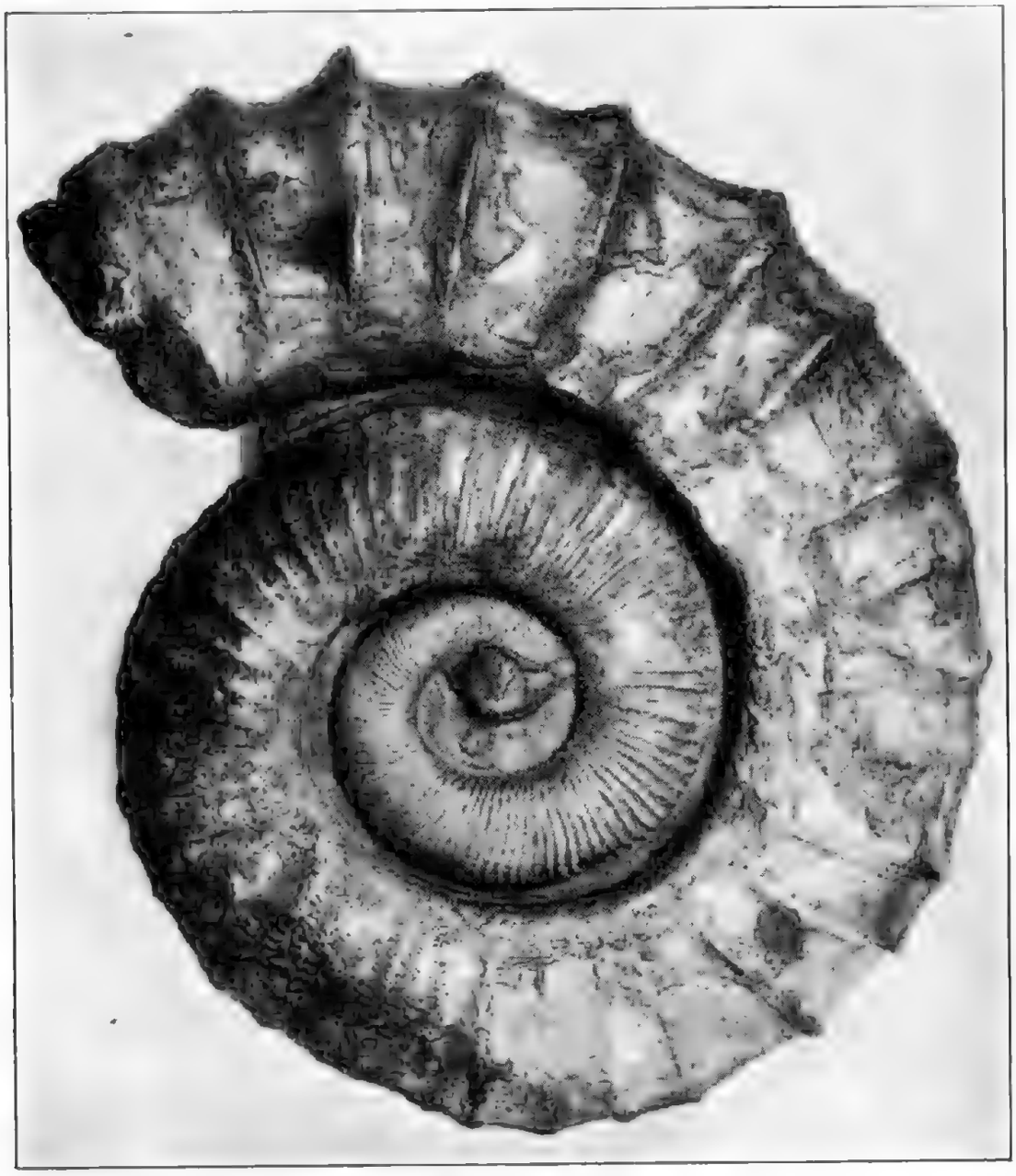

Fig. 144. *Tropaeum imperator* sp. nov.

bifurcate near the umbilical shoulder, are separated by sulci of equal or greater width.

Densiseptate; septal suture I.U.L.E., the various elements highly indented; septal saddles prominently and deeply bifid; septal lobes regularly trifid (fig. 145).

This form, as mentioned below, agrees perfectly with *Australiceras lampros* (Etheridge fil.) in details of ribbing, septal sutures, dimensions, and whorl-section. In two features, however, it is clearly distinct: the size is very much larger and the tuberculation is practically absent, though faintly suggested on the body-chamber. This undoubtedly represents a further example of a species-lineage changing from *Australiceras* to *Tropaeum* by the orthogenetic loss of tuberculation.

The specimen is of particular interest on account of its enormous size. It is by far the largest crioceratid known, though, of course, not the largest of the ammonoids. That distinction belongs to the well-known *Pachydiscus seppenradensis* Landois, from the Turonian of Westphalia, which reaches a diameter of 2 metres.

Very large size was attained in ammonoid stocks at various times. The Lower Lias, with *Coroniceras*, *Vermiceras*, etc., the Portlandian with *Gigantites*, and the Turonian with *Pachydiscus*, *Austeniceras*, etc., are particularly noticeable.

Among heteromorphic forms the Ancyloceratidae in particular specialize in megalomorphs; for, as recently restricted by Whitehouse (23), the family is comprised of four genera, *Ancyloceras*, *Australiceras*, *Tropaeum*, and *Ammonitoceras*, each of which is made up almost wholly of species of gigantic size. The earliest of these genera, *Ancyloceras*, is the least remarkable in this regard, although forms like *A. matheronianum* d'Orbigny and *A. variante* d'Orbigny are outstanding. All four genera are represented in the Roma Series of the "Rolling Downs Formation" by large forms; while in other countries they are just as remarkable for their megalomorphs. In Europe, e.g., *Australiceras gigas* (Sowerby, 1, vi, p. 188, pl. 593, fig. 2), *Tropaeum bowerbanki* (Sowerby, 3, p. 410, pl. 34, fig. 1), *T. hillsi* (Sowerby, 2, p. 339, pl. 15, figs. 1, 2), and related forms comprised a group, which, until the discovery of the Australian forms, contained probably the largest known heteromorphs. See, e.g., some of the forms figured by Sinzow (19). *Ammonitoceras* has correspondingly large species, e.g., *A. tovilense* Crick (22).

Genera belonging to other families which contain megalomorphs include *Crioceras (sensu stricto)*, *Distoloceras*, *Hamites*, *Anisoceras*, and *Flindersites*. The three genera last mentioned are represented in the Tambo Series of the

Fig. 145. Septal suture of *Trapezum imperator* sp. nov.

Rolling Downs by species of very considerable size; indeed, when the complete shell of *Flindersites flindersi* McCoy (see 18, pl. 39, fig. 1) is found, it will probably rank among the largest known heteromorphs.

It is thus of interest that, in both the major divisions of the Rolling Downs, megalomorphs of outstanding size are represented; the particular significance of this is not yet apparent.

The shell was extracted from the matrix in thirteen pieces, which together measure 10 feet 3 inches. The following table gives the length of each fragment, the diameter of the whorls in two directions; the number of costae to the inch in the earlier whorls; and the width of the sulci, in inches, in the later.

No. of Fragment.	Length of Fragment in inches.	Diameter of Whorl in inches. Vertical.	Transverse.	Costae. Number to the inch.
1	2½	1¾	1⅝	8 c. to 1 inch
2	10½	2¾	2½	11 c. to 3 ,,
3	12¾	4	3½	11 c. to 5 ,,
4	6½	4¾	4½	8 c. to 5 ,,
5	12½	5¼	4¾	5½ c. to 5 ,,
6	5½	—	—	5 c. to 5 ,,
7	8½	6	5¼	5 c. to 5 ,,
8	4	5¾	4½	3 c. to 4 ,,
9	15	6½	6½	2 in. apart
10	14	7	6½	2-3 in. ,,
11	6½	8	7	4½ in. ,,
12	16	8½	7½	4 in. ,,
13	9	8½	8	4 in. ,,

NOTES ON AUSTRALICERAS LAMPROS (ETHERIDGE Fil.).

In 1909 Etheridge (20, p. 157, pl. 48) described as *Crioceras lampros*, then a new species, the body-chamber of a huge crioceratid. This specimen is in the collection of the Geological Survey of Queensland, and at that time the locality whence it came was not known. Previously, in 1886, Jack (11, p. 75) had recorded a large crioceratid from the Walsh River, fifteen miles above the Telegraph Station. Some time after Etheridge's paper had appeared it was found that the body-chamber forming the type of *A. lampros* fitted exactly on the end of this other specimen, the join leaving no doubt that the two forms were but fragments of the one individual.

This reconstructed holotype of *A. lampros* measures 540 mm. in diameter, its dimensions, given according to the usual conventions, being 540, 30, 32, 76. The early whorls were trituberculate, though the portion of the shell anterior to

the penultimate tuberculate costa is missing. Tuberculation ceases at a whorl-diameter of 165 mm., the succeeding costae being non-tuberculate. At a diameter of 355 mm. the costae become coarse and flange-like, and thenceforth are again trituberculate.

In 1926, Whitehouse (21) figured a British Museum specimen from the Upper Flinders River as *Australiceras lampros*. The specimen was one of a number examined from the same locality and collection, but none had either the initial or the final stage preserved. It was obvious, however, that the early trituberculation was faint, in this respect differing from the holotype. Both forms agreed in dimensions, whorl-shape, in the course of the ribs, and in having about 80 costae per whorl on the non-tuberculate portion.

The present specimen differs from *A. lampros*, as mentioned above, in the tuberculation having practically disappeared, so that the Flinders River specimens are thus morphologically, and apparently genetically, intermediate between *Australiceras lampros* and *Tropaeum imperator*.

Recently one of us (F.W.W., 23), in discussing the ammonoids of the Roma Series, pointed out that three divisions were palaeontologically possible, namely, in descending order: Beds with 1. *Sanmartinoceras*, 2. *Tropaeum*, 3. *Australiceras*, but that the ranges of the two general *Australiceras* and *Tropaeum* probably overlapped to a slight extent. The holotype of *Australiceras lampros*, with its prominent tubercles, is no doubt from a horizon well down in the *Australiceras* beds; on *Tropaeum imperator*, however, tuberculation is so indistinct that the form has apparently just crossed the border-line between *Australiceras* and *Tropaeum*. It is suggested, consequently, that the specimen was derived from the base of the beds with *Tropaeum*. The lineage of *A. lampros* thus has probably an extended range.

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